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Technical application guide QUICKTRONIC® Intelligent DALI DIM

Light is OSRAM

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1 Introduction

1.1 Dimmable lighting installations

Dimmable electronic control gears (DIM ECGs) are playing an increasingly important role in all modern lighting technology applications. Dimmable ECGs from OSRAM integrated into the building management are at the heart of an intelligent lighting system that creates up to 80% energy savings compared to solutions with conventional control gears. The reason for this is that many requirements for lighting installations can be easily and elegantly realized with a light management system. Economy, light comfort, reliability and safety are the driving forces behind it.

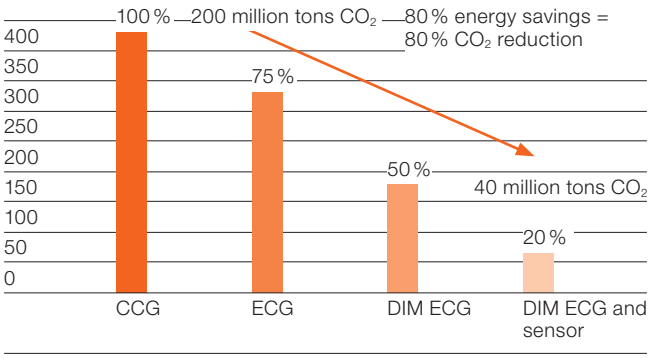
1.1.1 Economy

- Intelligent, energy-saving concepts in building management considerably reduce lighting costs:
  - Up to 50 % lower power consumption than when operated with magnetic, conventional control gears (CCG operation)
  - More than 50 % longer lifetime than conventional control gears (CCGs) and low-loss conventional control gears (LLCG) as a result of gentle operation
  - Low maintenance costs
  - Reduction of energy costs for air-conditioning units by reducing the cooling load

- Intelligent components:
  - Extremely low standby energy demand (< 0.2 W)
  - SMART GRID
  - POWER2LAMP
  - Emergency lighting (EL)
  - Corridor function
  - Touch DIM function

Worldwide energy savings potential with dimmable control gears

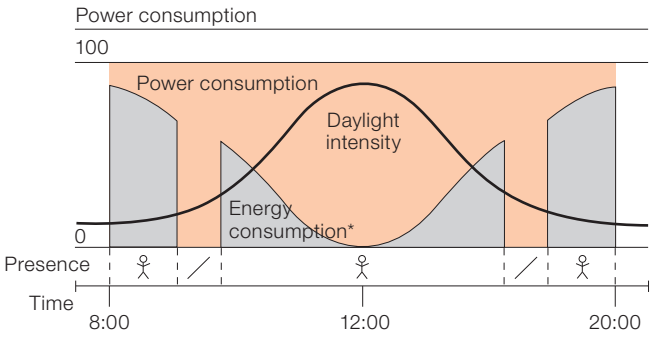
Changing from CCG (T8) > ECG (T8) > DIM ECG (T5) > DIM ECG with sensor (T5)



1.1.2 Lighting comfort

- Lighting situations at the touch of a button (lighting scenes), including integrated motion detection and daylight/time-dependent control increase lighting comfort. The properties of a high-quality dimmable ECG include:
  - Flicker-free start
  - Pleasant, continuously dimmable (1(3)…100 %) and flicker-free light without stroboscopic effects
  - Practically free of noise, no annoying humming from choke in CCG/LLCG
  - No flashing of faulty lamps
  - Automatic restart after lamp replacement
  - Easy of use, feedback to the control unit and settings for personal lighting values create individuality

Worldwide energy savings potential with dimmable control gears



Energy savings of up to 80 % with daylight and motion detection light management system

* With daylight and motion detection light management system

Advanced technical developments have made this possible. Modern dimmable ECGs with digital (DALI = **D**igital **A**ddressable **L**ighting **I**nterface) or analog (1…10 V) interface in combination with the corresponding control elements and sensors lay the foundations for easy and cost-effective realization.

1.1.3 Reliability/Safety

- Reliability and safety play a crucial role when using electronic control gears. The properties of a high-quality dimmable ECG include:
  - Preheating of the lamp filaments
  - Reliable lamp ignition to -20 °C ambient temperature [1)]
  - Reliable lamp operation in a temperature range of -20 °C to 75 °C
  - Reliable shutdown of the ECG in the event of failure, in particular at “end of life” (EOL, safety shutdown of the lamp at the end of its lifetime)
  - Complies with all currently valid ECG standards:
    - Safety (EN 61347) incl. EL symbols (Appendix J)
    - Operation (EN 60929)
    - Mains current line harmonics (EN 61000-3-2)
    - Radio interference from 9 kHz to 300 MHz (EN 55015:2006 + A1:2007)/CDN measurement in the frequency range above 30 MHz
    - Immunity (EN 61547)

1.1.4 The right control unit for every application

The dimmable ECGs are designed for multifaceted use. Typical applications are, for example, offices and industrial halls with daylight-dependent controllers, conference and meeting rooms with situation-based lighting or CAD rooms and switch rooms with individual adjustment of the level of light. The core of the lighting installation are the dimmable QUICKTRONIC® Intelligent ECGs from OSRAM with DALI or 1…10 V interface (QTi DALI/DIM) for operating compact and fluorescent lamps. These are controlled via a control unit, a sensor or simple push-button/rotary dimmer. The selection of the correct dimmer components to control the lighting depends on the desired application. The requirement profile for the dimmable lighting installation therefore needs to be defined in detail.

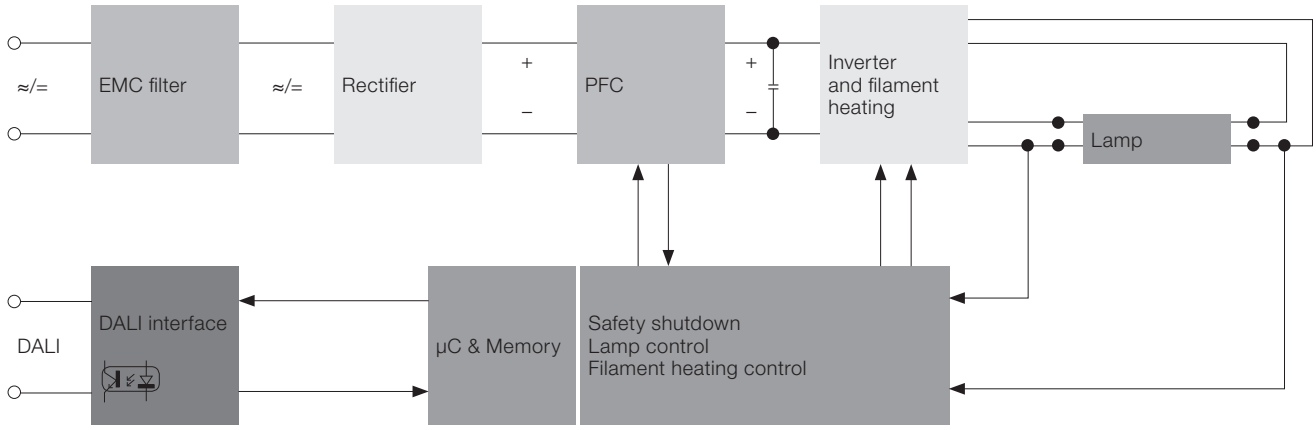
1) With 10 % dimmer setting ➔ max. power output ECG on the lamp

2 Overview of dimmable control gears

2.1 Block diagrams of a digital/analog dimmable ECGs[2)]

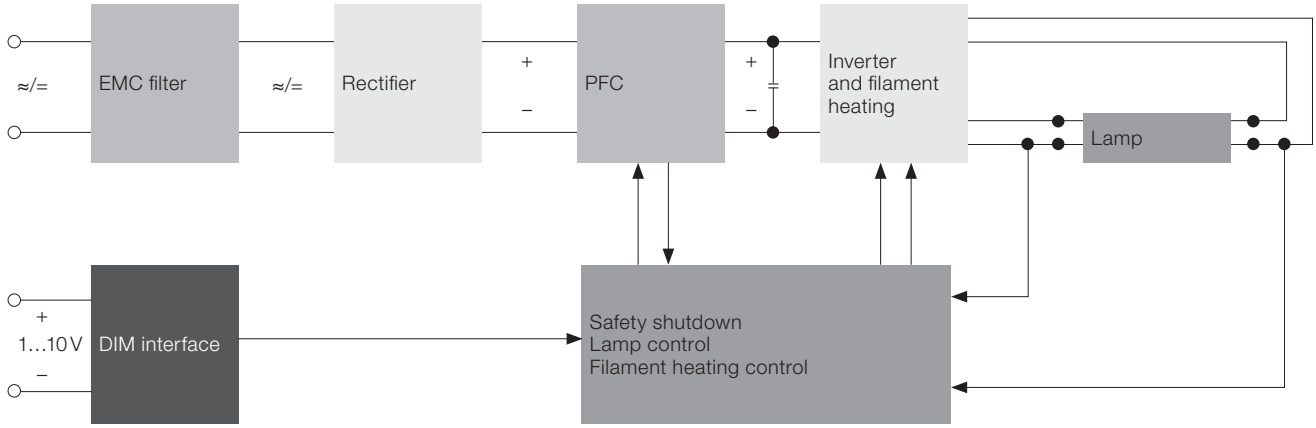
2.1.1 Block diagram of a digital dimmable ECG with DALI interface

The EMC filter and safety shutdown are important components of a high-quality dimmable control gear



2.1.2 Block diagram of an analog dimmable ECG with 1...10-V interface

The EMC filter and safety shutdown are important components of a high-quality dimmable control gear



2) • EMC filter for HF interference from 9 kHz to 300 MHz
• PFC: "Power factor correction" = correction of the line harmonics
• Inverter: Half-bridge driver with resonance cycle (40 kHz–120 kHz)
• Safety shutdown incl. "end of life" detection

2.2 DALI in comparison to 1...10 V and KNX/LON

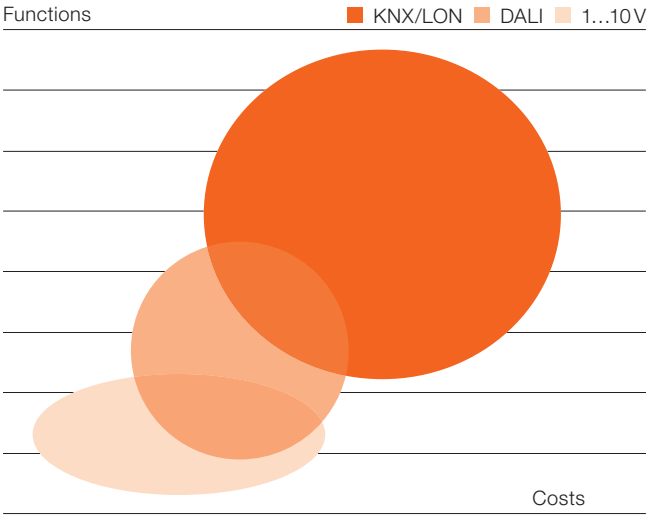
Modern lighting technology requires a system that is as flexible as it is simple and one which concentrates on the room-based light management system with few cost-effective components, simple wiring, and a user-friendly operating concept. For this purpose, the photometric industry has developed the new digital communication standard for lighting systems:

DALI closes the gap between the previous 1…10-V technology and complex bus systems. On the one hand, DALI offers a very simple local solution – on the other hand, however, it can also be integrated into a building management system as a sub-system.

2.2.1 DALI and 1...10-V properties

The defined physical properties at the interface as well as the properties of the interface cable as the transmission medium form the basis of every control system. Interference of the data transmission is largely ruled out for DALI thanks to a generously designed interference voltage distance as well as the wide ranges for digital “low” and “high”. This means that shielded control lines are not required. As with the 1…10-V interface, the mains and control inputs are galvanically separated in the ECGs. Safety extra-low voltage (SELV) was intentionally not used in order to make a cost-effective installation possible without having to lay additional special lines and cable bushings. For example, a 5-x-1.5-mm^2 NYM can be used for the main cable and DALI.

1...10 V, DALI and KNX/LON overview



With the materials and means of traditional electrical installations and even with the widely used analog 1…10-V interface, these requirements are challenging to achieve and only at great expense. A multitude of components needs to be used in order to modify a programmed scene while simultaneously enabling flexible group assignment and, where possible, integrating this into a daylight-dependent control.

DALI and 1...10-V interface in comparison

DALI	**1...10 V**
Floating control input, basic insulation	Floating control input, basic insulation
Two-wire line (polarity-free)	Two-wire line (with polarity +/-)
Addressing possible: • Individually (max. 64 addresses) • In groups (max. 16) • All together **➔ Wiring in groups not necessary**	Cannot be addressed • Wiring in groups is necessary
Scene memory (max. 16)	Not possible
Individual addressing of the DALI ECG	Not possible
Status messages from the DALI control gears • Lamp malfunctions • Operating duration • Dimmer setting	Not possible
Individual dimming options • Saving the last dimming value as the starting value	Not possible
“Switching” via interface	External mains voltage changeover switch (e.g. relay)
Additional features: Corridor and Touch DIM Function, emergency lighting (EL) and POWER2LAMP possible	Not possible

2.3 Installation and wiring instructions for dimmable luminaires/lighting installations

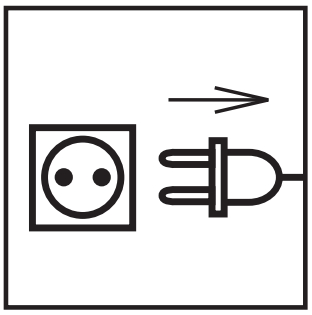
2.3.1 Burn-in instructions, wire insulation and voltage loads

- New lamps must be burned in for 100 hours at full power to achieve formation and basic stabilization. Interruptions while burning-in are permitted. Without burn-in, lamps may flicker and premature burn-outs or low lifetimes may be caused. For measurements in accordance with IEC 60081, the lamps also need to be burned in accordingly to achieve maximum luminous flux and optimal lamp stability.
- Dimming is generally only possible with filament preheating. The filament temperature must be constantly maintained through additional heating; otherwise, effects such as wolfram erosion (sputtering) or increased condensation in the emitter materials can occur.
- The control input (DALI as well as 1…10 V) is separated from the mains (230 V voltage-proof) through basic insulation (not SELV). The mains cable and control lines may therefore be conducted together in a 5-core NYM cable.
  Note (according to DIN VDE 0100/11.85, T520, section 528.11) [1]:
  - Cables or wires used must be insulated against the highest operating voltage or each wire of a multicore cable/multi-strand wire must be insulated against the next voltage occurring in the cable/wire.
  - If multi-wire cables are laid in cabling tubes or channels, only the wires of a main current circuit and those of the associated auxiliary circuits may be laid together.
  - Several main current circuits and their associated auxiliary current circuits may be combined in a cable (according to DIN VDE 0100/11.85, T 520, section 528.11).
- Cables and terminals must be used for installation which are approved for the mains voltage (230 V).
- The installation must be executed in such a way that all signal and control lines are shut down when the mains voltage shuts down.
- All components of the mains current and control current circuits must be designed for a 250-V working voltage to ground.
- All luminaires may be wired in connection with OSRAM DALI/DIM ECGs with H05 cables as long as the U-OUT is not exceeded by 430 V_{eff} – **and additionally tested in an isolation test (acc. to VDE)**. OSRAM QUICKTRONIC® DALI/DIM ECGs also do not exceed 430 V_{eff} for T5-Ø-16 mm HE and HO fluorescent lamps.

1) According to DIN VDE 0100, part 520, section 528.11, main current circuits and their associated auxiliary current circuits may be laid together, even if the auxiliary current circuits conduct a lower voltage than the main current circuits.

2.3.2 Safety and installation instructions

Installation and maintenance of electronic control gears only by qualified electricians



Disconnect the electronic control gear from the mains voltage before carrying out maintenance work

Only operate indoors or outdoors with a suitable type of protection

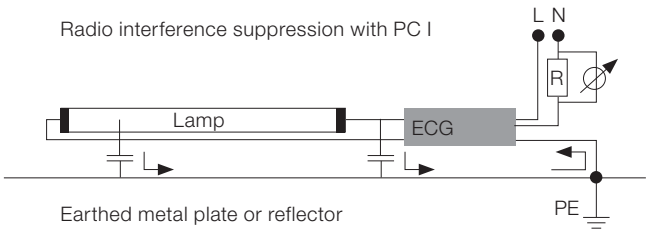
2.3.3 Wiring instructions for dimmable luminaires – suppression of radio interference

Replacing dimmable ECGs is only approved for luminaires of protection class I (PC I) because sufficient earthing is only guaranteed here.

Note

When dimming, the operating frequency of the lamp increases at the same time as the lamp voltage, which leads to increased leakage currents. Leakage currents emerging from the lamp always flow back into the ECG, because the electrical circuit must be closed. In order to keep the cable-related interferences to a minimum, the leakage current is offered another return path, the protective earth (= housing) and the PE connection of the ECG. In short: Interference-free dimming is not possible without protective earth. Dimmable ECGs only work in PC I luminaires and not in PC II luminaires, because the latter do not have a protective contact. Connecting the dimmable ECG to the functional earth is not permitted.

Protection class I luminaires



The maximum 50-Hz leakage current of the ECG over the leakage current circuit breaker (FI switch) is 0.5 mA.

- Mains and control lines may be routed together and should be laid tightly against the luminaire wall.
- Mains and control lines may not be laid close to the lamp cables.
- If crossing mains and lamp cables is unavoidable, they should cross vertically.
- Do not lay PE wires with the lamp cables.
- Do not use shielded lamp cables (reduction of capacitive leakage currents).
- The OSRAM DALI/DIM ECG must always be mounted near the lamp(s) to keep lamp cables short and thus attain good radio protection.

Notes

- Maximum lamp cable length of the “hot end” (higher potential to ground): T5, T8: 1 m/DULUX: 0.5 m
- Lamp cables that are too long cause the following problems:
  - Poorer radio interference suppression
  - Unreliable lamp detection (not with T8)
  - Poorer synchronization on the 2-lamp OSRAM DALI/DIM ECG
- Lay the lamp cables close to one another and near the lamp.
- Lamp cables may neither be laid in metal pipes, nor may they be shielded.
- The lines of the different lamp ends must be routed separately.
- With multi-lamp OSRAM DALI/DIM-ECGs, the lines to the respective lamp ends must be equal in length to avoid differences in brightness.
- When dimming with fluorescent lamps, the maximum of the lamp voltage is reached due to the negative voltage characteristic line in the lower dimming range (3 %-10 %).

Maximum line lengths between dimmable ECGs and lamps

	Cold ends*	Hot ends*
	1-lamp 21, 22	1-lamp 26, 27
	2-lamp 21, 22, 23	2-lamp 24, 25, 26, 27
T5	1.5 m	1.0 m
T8	1.5 m (2 m HF DIM)	1.0 m (1.5 m HF DIM)
DULUX D/E, T/E	All 0.5 m	

* “Hot ends” are the lamp cables which have the highest potential relative to the switching ground or protective earth. The other lamp cables (“cold ends”) have a lower potential relative to the earth.

Note

- Maximum capacity of a pair of filament wires to ground:
  - T8/DL: 150 pF
  - T5: 75 pF
- Maximum capacity between “hot” and “cold”:
  - T5: 15 pF
  - T8: 30 pF

2.3.4 Wiring instructions for dimmable luminaires when operating multiple ECGs in a luminaire

Operating multiple dimmable ECGs in a single luminaire can lead to interference effects and, therefore, to flickering, incremental dimming or, in the worst case, the ECG even shutting down if the design is unfavorable. The reason for this is the couplings between the lamp current circuits of multiple ECGs: If a lamp that is running at 100 % couples only 1 % of its power into the neighboring lamp dimmed to 1 %, this represents an error of 100 %. The same applies to couplings between a heating circuit, i.e. line-in and line-out of a lamp side and the neighboring lamp current circuit.

Therefore, maintaining a minimum distance of 12 cm between the lamp current circuits (lamp and lines) of the different ECGs is recommended. Where this is not possible, the coupling between the lamp current circuits must be reduced through especially careful wiring:

- Lay the lamp cables close to the associated lamps so that the surface which encloses the lamp current circuit becomes as small as possible. The lamp current circuits of two ECGs may not overlap.
- Several centimeters distance should be maintained between the lamp cables of the ECGs.
- The “short” lamp cables (see also ECG inscription; 1-lamp 26–27, 2-lamp 24–25, 26–27) should lead to one side of the lamp and be as short as possible (1 m T5, T8; 0,5 m T4), the “long” lamp cables to the other side of the lamp (1-lamp 21–22, 2-lamp 21–22, 21–23).
- Mains and control lines may not be laid close to the lamp cables to allow smooth operation (avoidance of unwanted couplings in the control line).
- All mains and control lines may be routed together. There should, however, be several centimeters distance between the lamp cables, so that the radio interference suppression is not affected.

– The distance between the lamps should be 32 mm; distances between the lamps and luminaire parts may never be less than 6 mm. No part of the luminaire should touch the lamp glass.

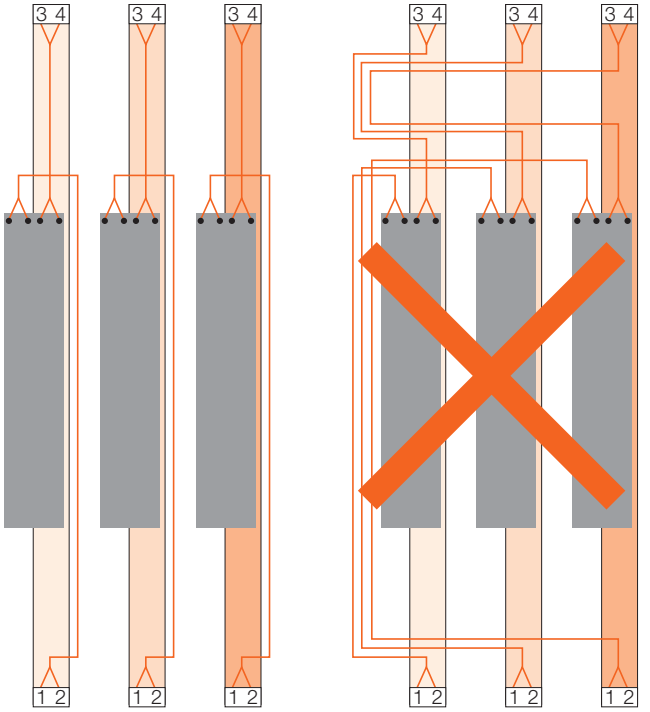
The better these recommendations are implemented, the quieter and more homogeneous the light at the lowest dimmer setting is and the earlier the full temperature range of the ECG can be used.

– In the “worst case”, twist the cables of the heating circuits together and ensure that they are laid close together. In the case of 1-lamp ECGs, these are lines 21–22 and 26–27, in the case of 2-lamp ECGs, lines 21–22 and 21–23, 24–25 and 26–27. This is especially important if neighboring ECGs are being operated at the lowest dimmer setting (1(3) %).

If problems still occur: Remove all lamps apart from the one(s) at the “problematic” ECG – this then rules out the errors caused by the other lamps. If the lamp then works flawlessly in the entire dimming range, the measures for uncoupling to the other lamp (lines) are not yet sufficient.

2.3.5 Wiring examples for dimmable control gears

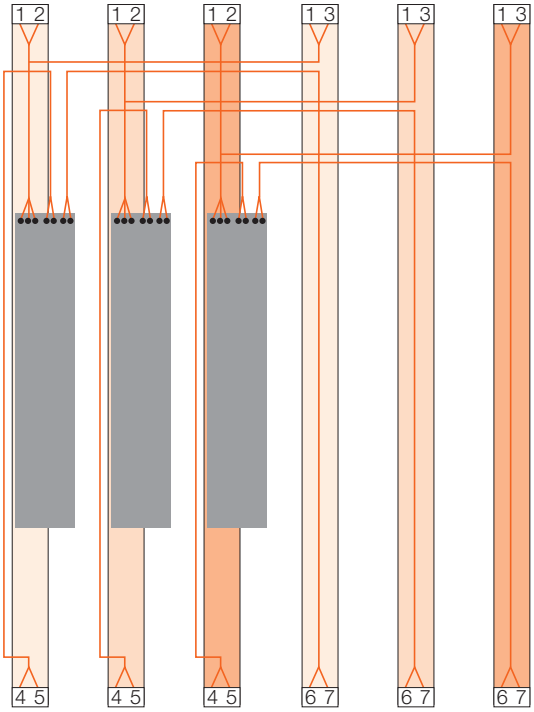
Three 1-lamp ECGs



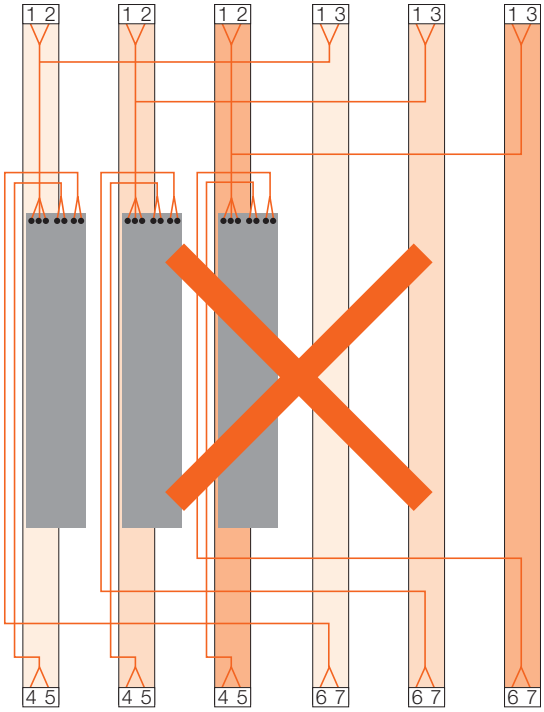
Correct:
The lamp cables are twisted and laid close to the respective lamps. None of the lamp current circuits are overlapping. The “hot” side is up, the “cold” side down.

Incorrect:
The lamp cables of all ECGs are laid together and they also form overlapping lamp current circuits.

Three 2-lamp ECGs



Correct:
The lamp cables are twisted and laid close to the respective lamps. The overlapping of the three lamp current circuits on the right is minimized.



Incorrect:
The lamp cables of all ECGs are laid together and they also form overlapping lamp current circuits.

Note
T5 fluorescent lamps should be inserted so that the lamp stamps are on the same side. The lamp stamp should be at the bottom (“cold spot”) with a vertical burning position. In the event of non-compliance, the lamp wattage data can fluctuate greatly. In any case, the function (as well as the requirements for evenness) should be checked at all dimmer settings using a sample setup.

2.4 The DALI interface – technical details

2.4.1 Simplified installation
The DALI installation is carried out with commercial installation material for 230 V mains voltage. Both wires not required in the case of five-core cables (e.g. NYM 5 x 1.5 mm²) can be used for the DALI interface – without taking the polarity into account. A separate bus line is thus unnecessary! ECG and control unit can be operated in different mains voltage phases.

2.4.2 Construction site operation
Switching the ECGs on or off (even without an installed/programmed control unit) is possible at any time via the fuse (basic DALI function). With brand-new ECGs, the light is always turned on at 100 % luminous flux.

2.4.3 Advantages of DALI ECG with group assignment
Each ECG in the DALI system can be individually and digitally addressed. Upon commissioning, each ECG is allocated the address and group membership. Each ECG can belong to up to 16 groups – including several groups at a time. The ECGs can be addressed individually, in groups or all together. The group assignment can be changed at any time – without interfering in the wiring.

2.4.4 Integrated scene memory
Each ECG can save up to 16 light values, independent of group memberships which may have been programmed. Cross-fading between the scenes runs synchronously. This means that all ECGs begin cross-fading onto the new scene at the same time and they also end simultaneously (by variation of the dimming speed).

2.4.5 ECG status report
The control unit can query the condition of each ECG. Thus, for example, a lamp malfunction (or failure) or the brightness of a lamp can be determined. The feedback capability of the OSRAM DALI ECG in connection with complex bus systems (KNX, LON) is crucial in building management systems (e. g.: the OSRAM DALI PRO screens lamp malfunctions and can transmit them via a floating signal contact; the OSRAM DALI magic (http://www.osram.com/osram_com/tools-and-services/tools/dali-magic/index.jsp) offers analysis using Wizard (software)).

2.4.6 Switching relay no longer necessary
The light is switched on and off via the interface. The previously required external relay for switching can thus be omitted.

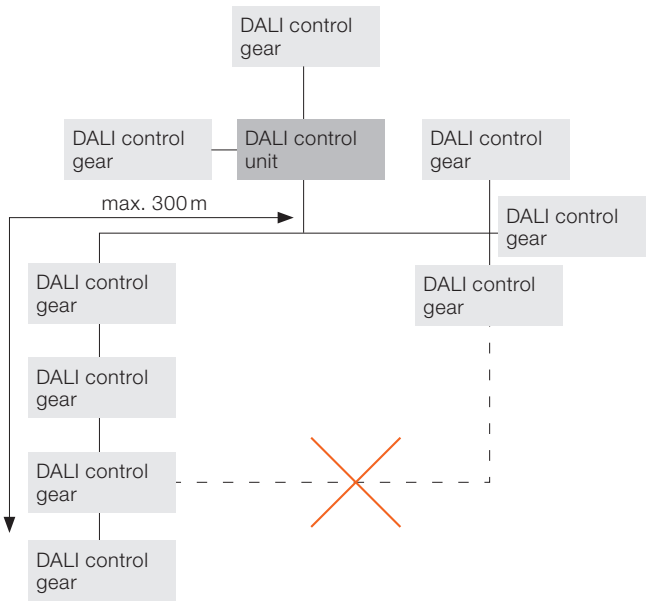
2.4.7 Addressing is not a must
DALI can also be used without being addressed (groups or individual addresses). The so-called “broadcast mode” is used here, where all control gears are addressed together.

The IEC 62386 “digital addressable lighting interface” (DALI) defines the digital communication between control units and control gears (ECGs). The subsequent chapters provide an overview of the most important properties of the DALI interface. Detailed information can be found in IEC 62386.

2.4.8 The DALI system principle
Each control unit works as the “master” and controls the communication on the control line. In contrast, ECGs may only answer as the “slave” upon request from the “master”. DALI is based on the principle of a system of distributed intelligence: An intelligent control unit communicates with intelligent components. The control unit gives, for example, only one command “Scene 1”, and the addressed ECGs set the light value stored in their scene memory, whereby the target value of all ECGs is reached simultaneously. Cross-fade times as well as scene values are freely programmable.

2.4.9 The DALI topology
All DALI control gears and the control unit are connected in parallel to the two-pole data line. The wiring can have a star or tree configuration; only ring configurations are not allowed for wiring (marked by X in diagram 8). Termination resistors on the communication line are not required.

DALI topology



2.4.10 DALI parameters in the ECG

The following data can be saved in the DALI ECG when a DALI system is started up:

- Group membership of the DALI ECG (maximum 16 groups, multiple assignment possible)
- Individual addresses for directly addressing each ECG (max. 64)
- Light values for the individual scenes (max. 16)
- ECG parameters that determine the device behavior:
  - Dimming speed
  - Behavior in case of failure of the voltage at the interface (“system failure level”)
  - Behavior in case of mains voltage return (“power-on level”)

In addition to the options named above, it is always possible to address all devices together, even without programming the devices beforehand (construction site function).

2.4.11 Transmission wire requirements

When selecting the cable, it must be ensured that the entire voltage drop does not exceed a value of 2 V at 250 mA on the control line. Mains supply and control line may also be routed in the same cable as with 1…10 V. Thus, a 5-core NYM cable can be used to connect the DALI ECG with no problem. The maximum total line length of a DALI system (control unit and connected ECGs) should not exceed 300 m. The required cable cross section for the control line can be determined according to the following formula:

$A\ [mm^2] = L \times I \times 0.018$

A = Wire cross-section in mm^2
L = Cable length in meters
I = max. current of the DALI supply power in A
0.018 = specific resistance of copper

The following is used as a basis for finding the cable cross-section (transmission and supply cable):

Cable length	Up to 100 m	100 m to 150 m	150 m to 300 m
Cable cross section	0.5 mm^2	0.75 mm^2	1.5 mm^2

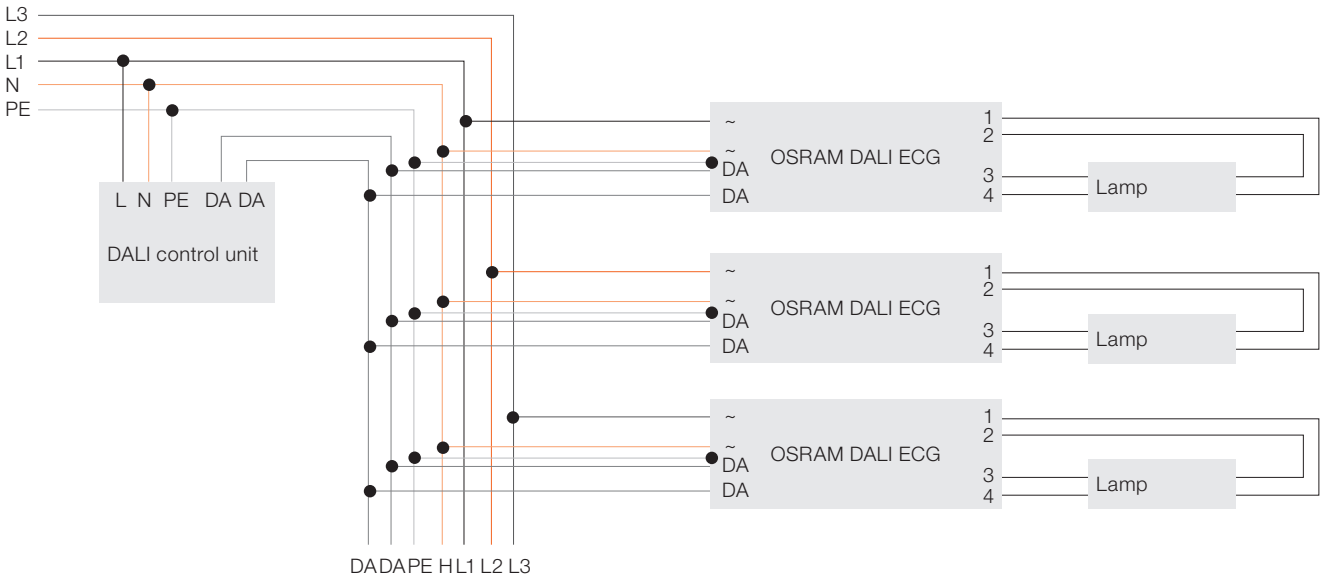
Note

Due to the different technical states of the DALI interface in control units on the market and the different local conditions for installation, limiting the entire line length used in the system to 300 m is recommended.

2.4.12 Connection diagram for the DALI ECGs

Control units and control gears may be connected to different mains phases.

Connection diagram for DALI control units



2.4.13 DALI data transmission

For DALI, the data line is supplied by a voltage source with current limiter. This source can be separately executed or integrated into another control unit. Typical characteristic values of the source are an open-circuit voltage of approx. 16 V and a short-circuit current of 250 mA.
A transmitter can modulate the data telegram on the line by periodically short-circuiting and releasing the line. All connected participants receive the data telegram by evaluating the voltage on the data line.
For DALI, the data is transferred using the Manchester code (two-phase code). In doing so, each bit receives an edge in the middle, which the receiver uses to reconstruct the transmission clock. The direction of the edge indicates whether the data bit has a value of 0 or 1. A falling edge means a logical 0 and a rising edge a logical 1. Access to the data line is regulated through the defined waiting times between the individual data packets.

2.4.14 Behavior in the event of failure

When there is no supply voltage at the DALI interface (control unit defective or switched off), the ECG activates the “system failure level”. The “system failure level” can be configured. Upon delivery, the “system failure level” is set to 100 %. After a mains voltage failure, the ECG sets the “power-on level”. The “power-on level” can be configured. The “power-on level” is set to 100 % when delivered. The “system failure level” takes priority over the “power-on level”.

The “system failure level” and “power-on level” can be configured, for example, with the OSRAM DALI Wizard or DALI magic.

2.5 The DALI dimming curve

2.5.1 Logarithmic dimming curve

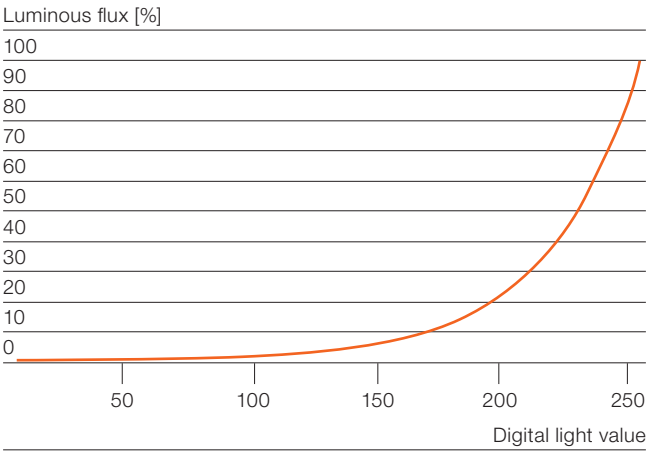
The IEC 62386 defines the dimming range of a DALI control gear from 0.1 to 100 %. The dimming curve is shown in the following graph. To the eye, this gradation corresponds to the linear behavior according to the Weber-Fechner Law[4].

The dependance of the relative luminous flux $X(n)$ on the digital 8-bit value n is described through the following correlation:

$$X(n) = 10^{\frac{n-1}{253/3}} \rightarrow \left|\frac{X(n) - X(n+1)}{X(n)}\right| = 2{,}8\% = Const.$$

This results in the following graphic correlation:

DALI dimming curve



Short overview of the most important dimming values

Percentage luminous flux	Digital dimming value
0	0
0.1	1
0.5	60
1.0	85
3	126
5	144
10	170
20	195
30	210
40	220
50	229
60	235
70	241
80	246
90	250
100	254

Because not all DALI control gears begin at 0.1 % luminous flux, the smallest value for DALI ECGs with a 1 % minimum dimming level is, for example, 85 (equals 1 %). All values under 85 (except 0 = off) are interpreted as a minimum level of light. So that no transitions between the individual digital levels can be seen when dimming, the DALI ECGs from OSRAM have a digital “smoothing” (additional function QTi to increase the light comfort, not part of the DALI Standard).

2.5.2 Linear dimming curve

In addition to logarithmic dimming, a linear dimming curve is also possible with the QTi DALI/DIM.
You can change from a logarithmic dimming curve (factory setting) to a linear dimming curve with the OSRAM DALI Wizard and DALI magic.

4) The Weber-Fechner Law states that the subjective strength of sensations behaves logarithmically relative to the objective intensity of the physical stimulus.

2.6 Features and performance characteristics of the digital interface

- **IEC 62386:** This allows devices from different manufacturers to be combined. A special feature which should be noted is that the manufacturers represented in the DALI Group [5] are continuously expanding the tests defined as standard to guarantee high functional safety.
- Physical user data rate of 1200 bit/s enables a fail-safe operation [6].
- **Safe interference voltage distance:** Safe operation is guaranteed as a result of the generously designed interference voltage distance of the high and low levels.
- **Data coding:** The Manchester code is used; this allows transmission errors to be recognized through its structure.
- **Maximum system current:** The maximum current that a central interface supply [7] may deliver is 250 mA. Each control gear may consume max. 2 mA. This must be taken into account when selecting the interface supply.
- **Limited system size:** A maximum of 64 control gears with an individual address can be differentiated in a system.
- **Information feedback:** ON/OFF, current brightness value of the connected lamps, lamp status etc. are possible.
- **Control and supply lines can be laid together:** A minimum cross section of the line must be taken into account. The maximum line length between two connected system participants should not exceed 300 meters.
- **Floating control input:** The control input is galvanically separated from the mains voltage (basic insulation, **however, no safety extra-low voltage (SELV)**). Thus, the ECGs may be operated on different external wires (phases).
- **No termination resistors required:** The interface lines must not be completed with resistors.
- **Dimming range 1 %-100 % (the lower limit depends on the lamp and manufacturer):** The progression of the characteristic line is standardized and adjusted to eye sensitivity (logarithmic characteristic line). An even impression of brightness results from standardization when using control gears from different manufacturers.
- **Programmable dimming times:** Special settings are possible, such as the rate of changing the lighting level (e.g. from 1 % to 100 % dimmer setting).
- **Disruption of the data line:** Defined light settings are automatically stored.
- **Saving lighting scenes (different group-dependent dimming conditions):** Saving up to 16 scenes is possible.
- **Connection to building management systems via converter:** The interface is primarily designed for room applications; however, it can be integrated into the building management systems via converters.
- **Easy new system configuration:** If the system is set once and configured, changes to the function of the system, the lighting scene and the lighting functions are only a matter of configuration and do not require any changes to the hardware. Example: Regrouping luminaires in a open-plan office.
- **Easy integration of new components.** If an existing lighting system is to be expanded, new components can be added everywhere within the system. When doing so, make sure that the system supply is sufficiently dimensioned.
- **Polarity-free interface**

2.7 Properties of the 1…10-V interface

Note

This chapter refers to OSRAM ECGs, models QTi DIM and QT DIM, hereafter abbreviated as OSRAM DIM ECG.

- They are controlled via a fail-safe DC voltage signal of 10 V (maximum brightness; open control line) to 1 V (minimum brightness; control line short-circuited).
- The control power is generated by the ECG (max. current: 0.6 mA per ECG).
- The voltage on the control line is isolated from the mains cable (basic insulation), however, without safety extra-low voltage (SELV).
- ECGs can be dimmed in different phases via the same control unit.

Note

The following must be observed due to the properties of the 1…10-V interface:

- All control lines of an ECG installation must be connected with the correct polarity (+/–).
- The control line is insulated from the mains cable, however, without safety extra-low voltage (SELV). This means that cables and terminals must be used for the installation which are approved for 230 V.
- Using a resistor, the control voltage can easily be limited up or down; several control units can be combined together.

5) Every ECG manufacturer that displays the DALI logo on the ECG is a member of the DALI Group.

6) 40 command/s and 16 bit ➔ 640 bit/s

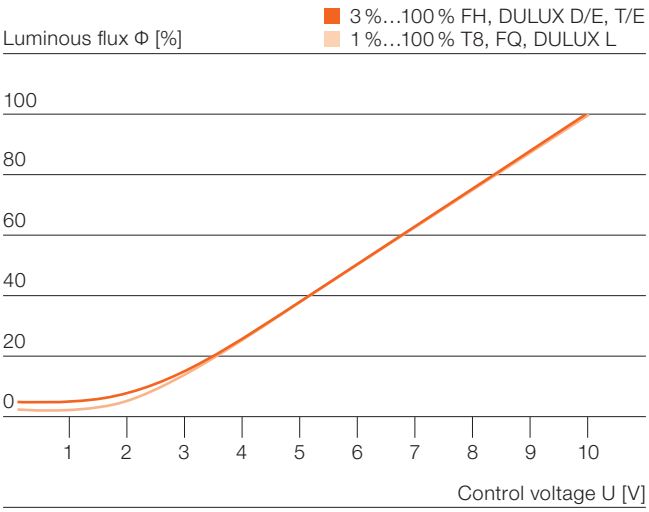
7) **DALI interface on the control unit:**
The DALI interface of the control unit also supplies the DALI interface of the connected DALI components. So that the maximum permissible total current of 250 mA is not exceeded, no additional DALI supplies or DALI control units may be connected in this system. In order to not exceed the maximum permissible voltage drop of 2 V, the cable cross section must be selected according to the table in the technical data.

- It is possible to test if the ECG is working properly as follows:
  - Switching on the ECG with open control line. The lamp must ignite and burn at maximum luminous flux.
  - Short-circuiting the control line (wire jumper). The lamp must burn at minimum brightness.
- Each OSRAM DIM ECG can be used as a normal, non-dimmable ECG if a control unit is not connected to the control line.
- The dimmable ECGs are only dimmed via the 1…10-V interface; switching is executed via the mains cable.
- The maximum capacity of the control unit (switch output and 1…10-V output) must be observed.
- The respective connected control unit must be in the position to absorb the current delivered by the ECGs into the control line (current sink) and minimize the control voltage. This requirement is fulfilled by the potentiometers, which are dimensioned accordingly, and all OSRAM control components. Normal power supplies, converter cards etc. do not necessarily have this property. For screening, connect the control unit, adjust to the lowest brightness and measure the voltage of the control line. The setpoint is 1 V or less.
- OSRAM DIM ECGs can not be dimmed via the mains cable (e.g. with phase alignment, ripple control pulses, or similar methods).

2.7.1 The 1...10-V dimming curve

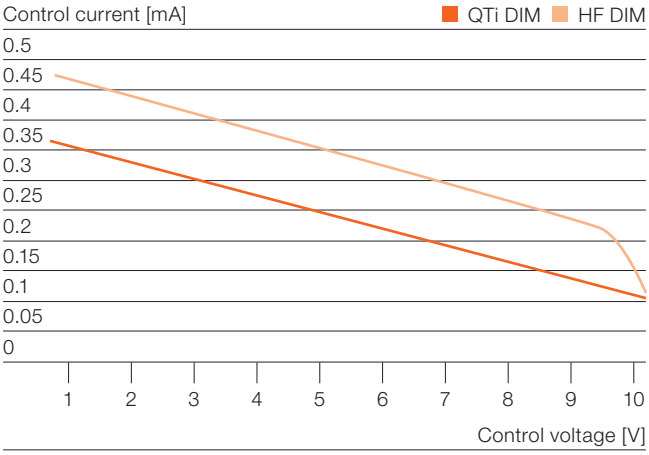
The 1…10-V interface is defined in the IEC 60929. Within the control voltage range of 3 V to 10 V, there is a largely linear correlation to the relative luminous flux. The logarithmic behavior (analog to the DALI devices) is simulated in the 1…10-V interface through a logarithmic potentiometer.

The 1...10-V characteristic line: Luminous flux against control voltage



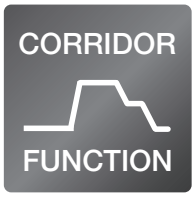
With the 1…10-V interface, the control current decreases as the control voltage increases.

Decreasing control current with increasing control voltage



3 New properties of QTi DALI

3.1 Corridor Function and parametrization options



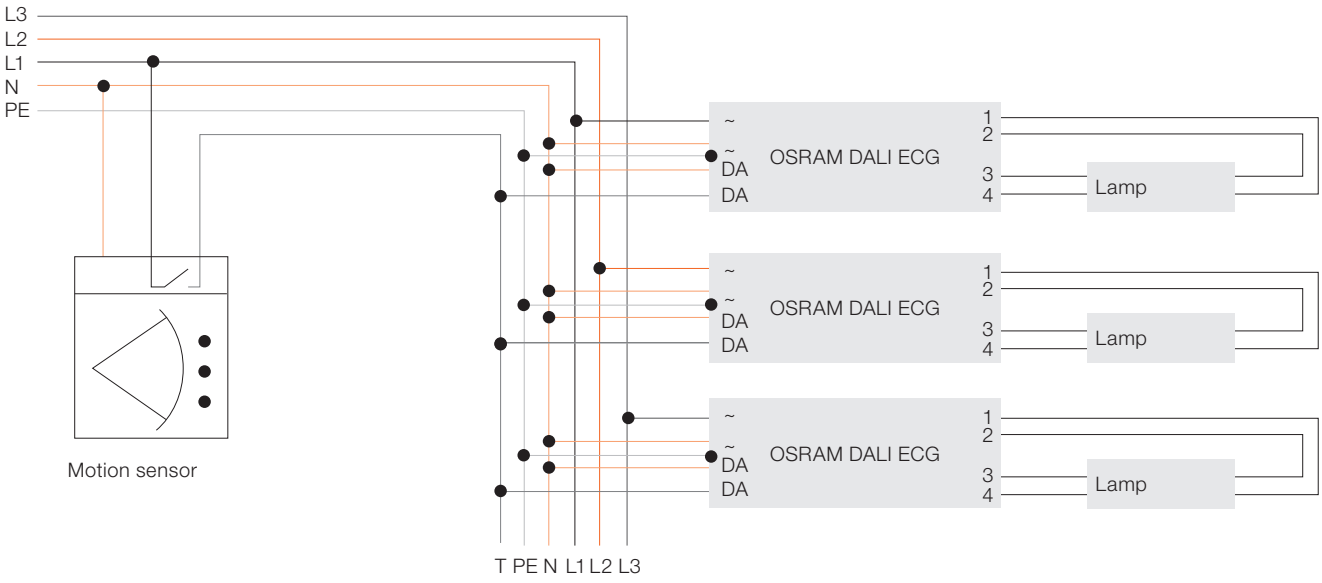
3.1.1 Description

Corridor Function: It is possible to connect the ECG directly to commercially available motion sensors. The Corridor Function is triggered by a switching signal, i.e. the voltage of the supply line (220–240 V, 50/60 Hz) is switched to the DALI control line inputs (DA, DA; see the diagram below). A preset “out-of-the-box” luminous flux program launches upon triggering. This can be individually adjusted via OSRAM DALI Wizard and DALI magic. Three light value ranges and six time ranges are available for this purpose. Several OSRAM DALI ECGs can be synchronized in an installation via the frequency of the mains voltage (50/60 Hz). The maximum number of ECGs in an installation is only limited by the sum of the inrush current surges from the individual ECGs. Additional installation instructions can be found in chapter 10.8.

Advantage

Development of new applications (stairwells, corridors, large storage facilities, …) with the possibility for saving energy and achieving high energy efficiency.

OSRAM DALI ECG wiring diagram for Corridor Function



3.1.2 Activating the Corridor Function

Activate the Corridor Function by permanently applying the supply voltage (220 V–240 V) to the DALI input of the ECG for at least 120 seconds (50 Hz) and 100 seconds (60 Hz), respectively.

3.1.3 Changing from the Corridor Function to the Touch DIM Function

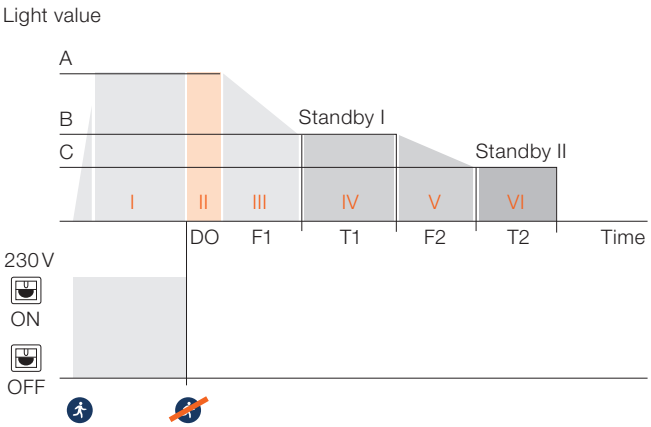
It is possible to change from the Corridor Function to the Touch DIM Function by briefly pressing a push-button 5 times (at the DALI input, 220 V-240 V) within 3 seconds.

3.1.4 Setting Corridor Function parameters

The Corridor Functions are easily programmable with the DALI magic/Wizard system (also see DALI magic manual at: http://www.osram.com/osram_com/tools-and-services/tools/dali-magic/index.jsp), i.e. the programmed settings (e.g. extent of the three light ranges, duration of the six time ranges) remain saved in the DALI ECG.

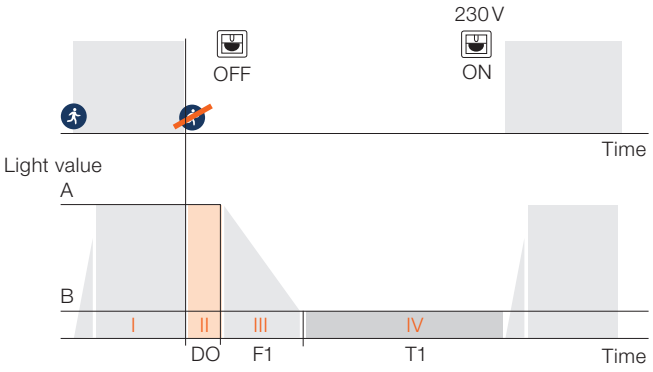
Corridor Function phasing (general and factory setting)

General curve:



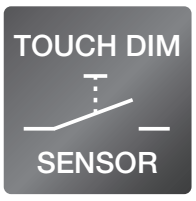
Three dimming ranges (1…100 %), free parameterization of time (I…VI) using DALI magic.

Factory setting:



Factory-set parameters:
A: 100 %, D0: 120 s, F1: 32 s
B: 10 %, T1: unlimited

3.2 Touch DIM Function

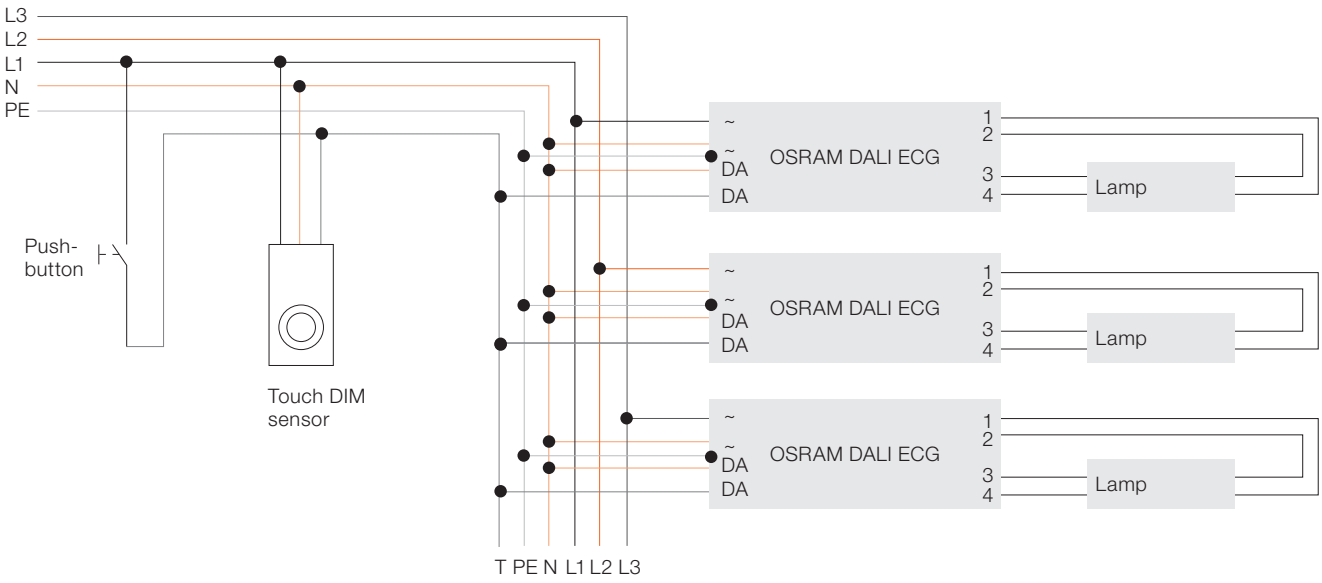


Dim up to 20 DALI ECGs using commercial push-buttons!
In addition to operation on DALI control units, QTi DALI ECGs offer the possibility of Touch DIM operation.
The QTi platform now enables up to 20 ECGs to be dimmed using commercial push-buttons with no problem.

Dimming up to 4 DALI ECGs with one Touch DIM sensor.

Additional properties are described in chapter 4.2.

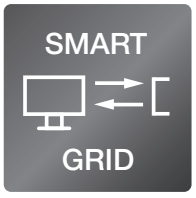
OSRAM DALI ECG wiring diagram for Touch DIM Function



3.3 Emergency lighting: DC voltage detection, EL (optional)

Furthermore, in addition to the “system failure level” (i.e. dividing up the control line) used in accordance with the DALI standard, an optional automatic detection of the DC power supply is possible with a luminous flux setting between 0–10 %. The variably adjustable luminous flux value between 0…100 % is protected from inadvertent over-writing by a locking bit. Emergency lighting operation can be optionally set using an OSRAM DALI magic or a DALI control unit.

3.4 SMART GRID and management

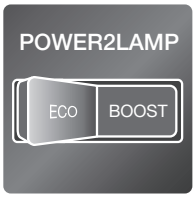


With the QTi DALI, the mains power being used at present, the current lamp burn time (can be reset) as well as the lamp status (whether “defective”) and the current ECG operating temperature can be read out.

For even easier error analysis, the maximum temperature occurring in the ECG, the integral of overtemperature x time, the maximum occurring mains input voltage and the time that the ECG was operated with surge voltage can be read out.

Advantage: Better traceability of errors in the field. Current power consumption measurements are increasingly required by users of larger lighting installations.

3.5 POWER2LAMP power matching (optional)



Another additional function that is interesting for users as well as luminaire manufacturers is the optional adjustable POWER2LAMP mode. If, for example, you use the DALI GII ECG (power-regulated ECG) in the “factory default” mode, a T5 Energy Saver lamp is operated with around 10 % more output and the user has a higher absolute luminous flux. Optionally, the DALI ECGs can also be set to the nominal output for Energy Saver lamps (ES-mode) using OSRAM DALI Wizard. Energy is saved as a result and, in certain applications, a higher ambient temperature of the luminaire is achieved.

4 Additional properties of dimmable control gears from OSRAM[8)]

4.1 OSRAM DALI/1...10-V ECGs: Added value through intelligent features

- Automatic lamp detection through intelligent multi-lamp operation (reduction of the ECG range of models)
  - Lamps of the same length and various outputs can be operated on a single ECG. Furthermore, special approvals exist for certain lamp/ECG combinations.[9)]
- Dimming range up to 1 % of the nominal luminous flux (3 % in the case of CFL, also HF DIM)
- Ignition of the lamp at -25 °C ambient temperature
- Optimized lamp warm start within 0.6 s (also HF DIM)
- Temperature-dependent “cut-off” in case of dimmer settings > 80 %
  - Shutting down the filament heating at dimmer settings > 80 % avoids a permanent heating current through the lamp electrodes during operation. The load on the filaments and the power loss are reduced by approx. 2 W as a result. “Cut off” is not active at low temperatures, which makes operating the lamp easier for conventional lamps[10)] and amalgam lamps.
- Intelligent temperature management
  - Power reduction control through the ECG to protect the electronics in case of excessive ambient temperatures ➔ Use is possible in extremely tight, hot luminaires (lifetime, efficiency increase, approbation)

Note

- The ECG measures its internal temperature on the intermediate circuit capacitor (electrolytic capacitor) 1 x per minute. It begins to reduce the power at 84 °C to lower the internal temperature of the luminaire and maintain the temperature of the electrolytic capacitor at 84 °C. The t_c temperature remains between 75 °C and 80 °C, depending on the installation conditions (heat coupling from above or below). At an ambient temperature of 25 °C (in the room, e.g. office), a reduction in the ECG power by 10 % is also sufficient for hot luminaires. Very little light is lost in the process because the efficiency of lamps and ECGs is improving. ➔ Most efficient energy savings measure compared to normal operation.
- High t_c point values (t_c = 75 °C) enable operation at high ambient temperatures (t_a values).
- Stable dimming operation even in amalgam lamps (CONSTANT lamps) ➔ Especially suitable for use in areas with low ambient temperatures (e.g. cold stores, outdoor areas) or high temperatures
  - Intelligent power control when detecting instabilities in the lamp circuit (amalgam lamp start) preserves the lamp and ECG
  - Optimized filament heating and lamp operation in case of mains undervoltage (no damage to the lamps)
- EOL shutdown after test 2

  - Asymmetric power test for detecting defective lamp electrodes or high-impedance lamp sections, e.g. through leakages in the glass tube
- Chip ID (**CIN** = **C**hip **I**dentification **N**umber, series number) for easy system installation ➔ OSRAM **DALI magic**: Address allocation is possible via CIN
- EEPROM for ensuring settings/parameters even in the event of power failure
- Lamp replacement without mains reset (automatic restart of lamps after lamp replacement, including HF DIM)
- DC operation in the input voltage range of 154–276 V/ lamp start above 198 V (i.e. no lamp ignition e.g. at 170 V DC)
- Optimized radio interference supression: Compliance with the required EMC specification limits with a comfortable safety margin to make it easier to install the luminaire (including HF DIM)
- DALI standard according to IEC 62386 - 101/-102/-201
- 1...10-V standard according to IEC 60929

8) Valid for OSRAM QUICKTRONIC® Intelligent (QTi) DALI/DIM ECG, exceptions indicated in (...)

9) Special approvals of ECG lamp for QTi-DALI/DIM, HF DIM models

10) Amalgam-free low-pressure gas discharge lamps

4.2 OSRAM DALI ECG and Touch DIM interface

To be able to make simple light management systems, the DALI ECGs from OSRAM also have the integrated Touch DIM Function. This makes it possible to dim and switch DALI ECGs directly with mains voltage using the DALI control terminals (Touch DIM interface = TDI). Only one commercial push-button is required; the controller takes over the ECG.

The **transition between both operating modes** – Touch DIM and DALI operation – can only occur after a power voltage disruption. During operation, switching between the operating modes is not possible due to an integrated safety interlock. You can change between the two operating modes as often as you like. Touch DIM may never be used at the same time as a DALI control system.

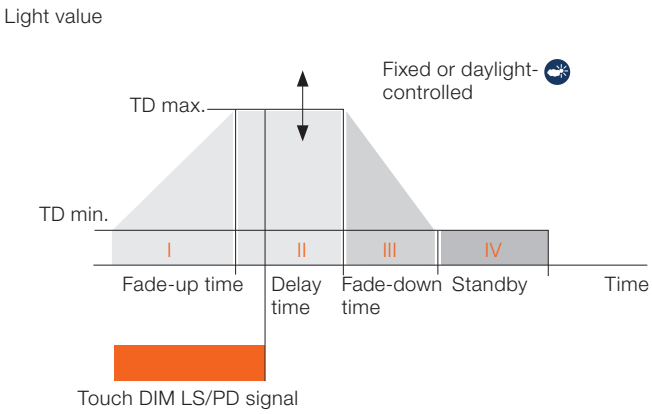
Touch DIM provides all functions of a comfort dimmer:
- Soft start of the lamp (lamp start in the lowest dimmer setting (1 %, lowest luminous flux)
- Press briefly: On/off
- Press and hold: Dimming
- Memory function (light value memory with double-click)
- All settings remain intact even in the event of power failure

New expanded Touch DIM properties:
- **Set the Touch DIM parameters flexibly with DALI magic programming device and Wizard software**
- **Automatic shutdown of the lamp once there is sufficient ambient light (controlled with the Touch DIM light and motion sensor)**
- **Optimized synchronicity (control of up to 20 ECGs on one push-button is possible)**

4.2.1 Setting Touch DIM Function parameters

With the new generation of OSRAM DALI ECGs (GII), all Touch DIM parameters (e.g. min./max. level of light, fade-up and fade-down time etc.) can be freely programmed with a DALI magic programming device (see DALI magic manual).

Touch DIM Function phasing



Free parameterization of all **Touch DIM parameters** (I…VI) with a DALI magic

Factory settings:
Fade-up time: 0.7 s (TD min.: 1 %, TD max.: 100 %)
Fade-down time: 32 s
Delay time: 15 min
Standby time: 5 s

4.2.2 Automatic lamp switch-off at sufficient light level

When using the Touch DIM Function with a light and motion sensor (LS/PD signal), the level of light can be constantly maintained at the workplace (ECG readjusts artificial light).

The following correlation applies in the process: The more natural light is available, the less artificial light (lamp) is required to maintain a constant level of light at the workplace.

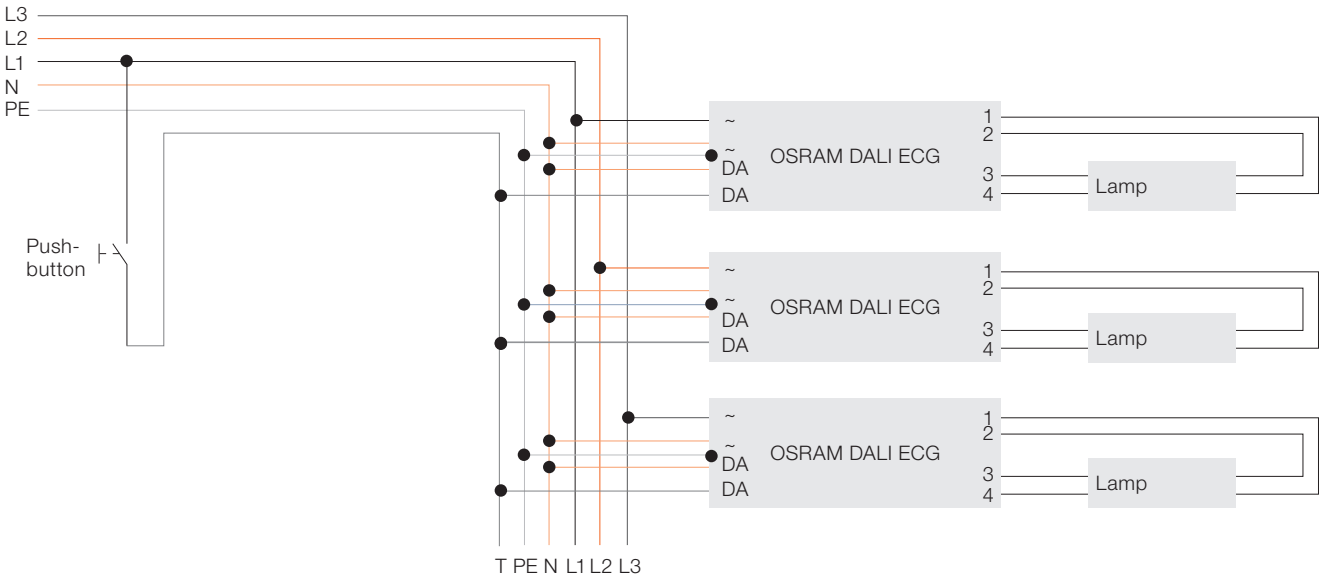
When using the control limits (lowest dimming level (TD min.)), DALI GII ECGs offer the possibility of shutting down artificial light (ignoring the PIR sensor signal as long as the light sensor detects a level of light that is over the selected setpoint for more than 1 min). If the natural level of light falls below the setpoint by more than an adjustable threshold value (factory setting approx. 25 lux), the artificial light is switched on again to ensure a constant level of light at the workplace.

11) Touch DIM is not part of the DALI standard.

4.2.3 Wiring and cable compensation

- The cable length between the push-button and the farthest DALI ECG may not be longer than 25 meters. Compensation measures must be applied for line lengths required to be more than 25 meters long (bell transformer, resistance).
- Do not use more than 20 DALI ECGs in a single Touch DIM application (up to 20 ECGs can be controlled by one push-button). The greater the number of DALI ECGs controlled simultaneously, the greater the risk of asynchronisms (see 3.2.6.2).
- Differing lamp families should not be mixed due to different preheating times (e.g. T5-HO lamps (500 ms start time) vs. T5-HE lamps (700 ms start time)).
- Multiple control points are possible, provided the total line length of 25 m is not exceeded.
- **Touch DIM sensor:** No more than **four DALI ECGs** may be operated with a single Touch DIM sensor. Maximum cable length (distance sensor/DALI ECG) is **10 meters.**
- The Touch DIM wiring and the operator button must be rated for mains voltage (230 V).

Operation via push-button



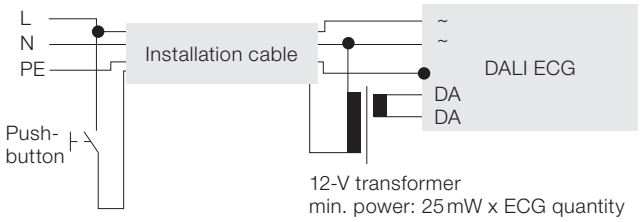
4.2.3.1 Operating parameters for Touch DIM and Corridor functionality

AC voltages of 10…230 V (effective value) with a frequency of 48...63 Hz must be used for operating Touch DIM and Corridor functionalities – not DC voltage.

4.2.3.2 Interference compensation (for wiring > 25 m)

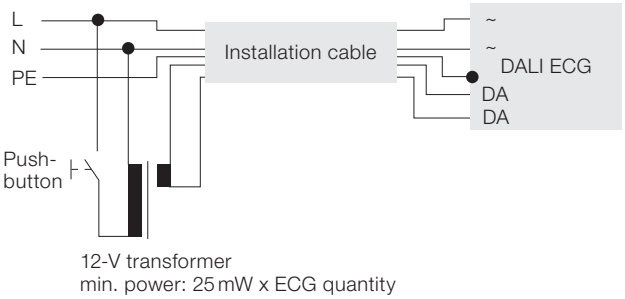
Above a total cable length of 25 m to 100 m from the push-button to the ECG, a control transformer according to both of the following diagrams must be used to prevent malfunctions (e. g. through capacitive couplings): Primary 230 V/ secondary 12 V, required transformer power: 25 mW per connected ECG (i. e. 150 mW with 6 ECGs, 2 mA control current per ECG).

Control transformer for compensation near the ECG (e. g. in a luminaire)

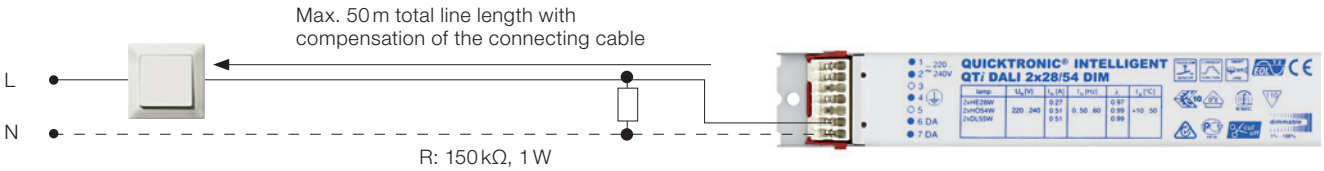


Furthermore, there is the opportunity to switch a conventional resistor (1 W, 150 kΩ) to compensate for interference (damping of the line) between phase and neutral wire, which is illustrated in the following diagram.

Control transformer near the push-button (e. g. in the SD (sub-distributor) or a FTB (flush-type box)).



Compensation for the connecting cable through a resistor (1 W, 150 kΩ) [12)]



12) E. g.: Vishay Beyschlag: MBA/SMA 0204, MBB/SMA 0207, MBE/ SMA 0414 - Professional

4.2.4 Touch DIM operation

- Switch lamp on/off: Briefly press push-button (< 0.5 s).
- Dimming: Press and hold push-button (> 0.5 s, dimming direction changes with every press of the push-button).
- Store the reference value when switched on: “Double-click” (briefly press 2 x within 0.4 s).
- Delete reference value: Double-click when lamp is switched off (ECG starts with 10 % luminous flux when restarting).

Note

Holding the button longer when the lamp is switched off: The lamp switches on at the minimum dimmer setting and reduces amount dimmed until the push-button is released.

4.2.5 Operating modes with Touch DIM

With QTi DALI/DIM, OSRAM offers two operating modes for Touch DIM (mode 1, mode 2), which differ in how they switch on (switching on/off with the push-button is meant here, not disconnection of the supply voltage):

Mode 1:

The control gear switches on with the dimming value that was set before it was switched off. The following applies: press briefly: switch, press and hold: dim/switch on at a minimum dimmer setting.

Mode 2:

The control gear switches on with the dimming value that was saved previously by double-click (preset value). The following applies: Press briefly: switch, press and hold: dim/switch on at a minimum dimmer setting.

The following table illustrates the options of both operating modes for the user:

Behavior of the ECG after various push-button actions, TDI = Touch DIM interface

Action	Touch DIM
Press briefly (state: switched off)	TDI mode I: Switches on with last value before shutting down TDI mode II: Switches on with last double-click value
Press briefly (state: switched on)	Switches off and saves value in TDI mode I for next switch-on
Press and hold (state: switched off)	Switches on and from minimum, dims up as long as the push-button is pressed
Press and hold (state: switched on)	Dims up and down (depending on pending toggle function or logic function)
Double-click (state: switched off)	Changing to TDI mode I (= auto memory of the switch-on value) Confirmation: Switching on and dimming to maximum brightness
Double-click (state: switched on and dimming in the last 30 s)	Changing to TDI mode II (switch-on value = double-click value) Confirmation: Flashes and dims to double-click value
Double-click (state: switched on and **no** dimming in the last 30 s)	Holiday switching; only in combination with LMS sensors (see LMS documents)
Power voltage disruption (state: switched off)	Remains switched off
Power disruption (state: switched on)	Switches on to … TDI mode I: Last value before the power disruption TDI mode II: Last value before the power disruption

4.2.6 Asynchronism

As a matter of principle, asynchronisms can occur with push-button operation in systems with more than one ECG. The higher the number of ECGs and the longer the control line length, the greater the chance of asynchronisms.
In order to avoid lighting installations running asynchronously in practice, **the permissible number of ECGs (20) and the total line length of 25 m must be adhered to**.

4.2.7 Synchronization

For physical reasons, a Touch DIM system can work asynchronously; in other words, the switching state and dimming direction of the individual luminaires are different. The following steps are used to synchronize a Touch DIM system:

1. Step:
Press and hold (> 0,5 s) ➔ All luminaires switch on
2. Step:
Press briefly (< 0,5 s) ➔ All luminaires switch off
3. Step:
Press and hold (> 0,5 s) ➔ All luminaires switch on and dim
4. Step:
Double-click ➔ Saves dimmer setting (if desired)

After these steps are executed – **long–short–long–(double-click)** – the ECGs act synchronously once again.

Note
Touch DIM was developed for manual control and is not suitable for automation, e.g. for connecting an SPS.

4.2.8 Avoiding asynchronisms: DALI repeater
With the help of the DALI repeater, which is described in detail within the context of the LMS portfolio, up to 64 ECGs can easily be operated in the Touch DIM function without any problem with asynchronisms.

LMS repeater: http://www.osram.com/osram_com/products/electronics/light-management-systems/components/repeaters/index.jsp

4.2.9 Behavior after power voltage disruption
If the luminaire is disconnected from the mains, the ECG saves all set values. If the light value was modified prior to shutdown, this value is set again. In other words, the exact prior state is reproduced after a disruption of the voltage (immediate switching on with the previous luminous flux, no "middle road" via 100 % luminous flux and subsequent dimming). All settings (dimming values, lamps on/off …) remain intact even if the power failure lasts a while (> 200 ms…5 s, depending on the ECG and the operating status). The reference value saved with double-click also remains saved in the ECG after the power voltage disruption and can, if desired, be recalled again with luminaire on/off. If the luminaire was shut down as the result of a power voltage disruption, it remains off if the mains voltage returns. For this reason, operation in Touch DIM mode is not suitable for centrally supplied emergency lighting applications.

4.3 OSRAM DALI ECGs in emergency lighting applications (EL – Emergency Lighting)

OSRAM DALI ECGs bear the EL quality mark. This means that OSRAM DALI ECGs meet the following standards for operation with central batteries:

1. Equipment safety according to IEC or EN 61347-2-3, appendix J
2. Equipment safety according to IEC or EN 61347-2-13, appendix J (2nd issue in preparation)
3. Luminaire safety according to IEC or EN 60598-2-22 (4th issue in preparation)

Due to the multitude of emergency lighting control systems and applications, this topic cannot be described comprehensively in this technical application guide.

Integrating and testing the total emergency lighting system according to DIN V VDE V 0108-100 and DIN EN 50172 must always be executed by the party responsible for the total system, because the DALI ECG is only one component of the total system. DIN V VDE V 0108-100 und DIN EN 50172 are system standards and not ECG standards.

Special electronic control gears are available on the market for local emergency lighting applications with integrated battery in the luminaire. The instructions described here for wiring and programming the DALI control gears refer exclusively to central battery applications and, therefore, to standard DALI control gears (ECGs).

QUICKTRONIC® Intelligent DALI ECGs are suitable for emergency lighting systems according to DIN V VDE V 0108-100 and DIN EN 50172. All OSRAM DALI control gears detect emergency operation ("system failure level") by the missing voltage at the DALI input (16 V DC during normal operation). This function is a part of the DALI standard and is supported by all manufacturers.

New, expanded properties:
OSRAM DALI (GII) ECGs can detect a failure in the emergency lighting applications (EL) without an additional DALI command (operating range: 154–276 V (0 Hz/pulsating DC)). The "system failure level" is automatically set. The EL function can be switched on or off via DALI magic/Wizard (see the DALI Wizard manual: http://www.osram.com/osram_com/tools-and-services/tools/dali-magic/index.jsp).

- EL quality marks (according to IEC 61347-2-3) with EBLF, EMC…
- Operating range: 154–276 V (0 Hz/pulsating DC)
- Flexible switching on/off with DALI magic
- "DC level" has higher priority than the "system failure level"
- Locking emergency lighting settings possible via DALI
- Automatic reinstatement of the AC conditions, in other words, the conditions present before the failure of the AC (mains) voltage

Typical data for the QUICKTRONIC® Intelligent DALI family that are significant for emergency lighting systems*:

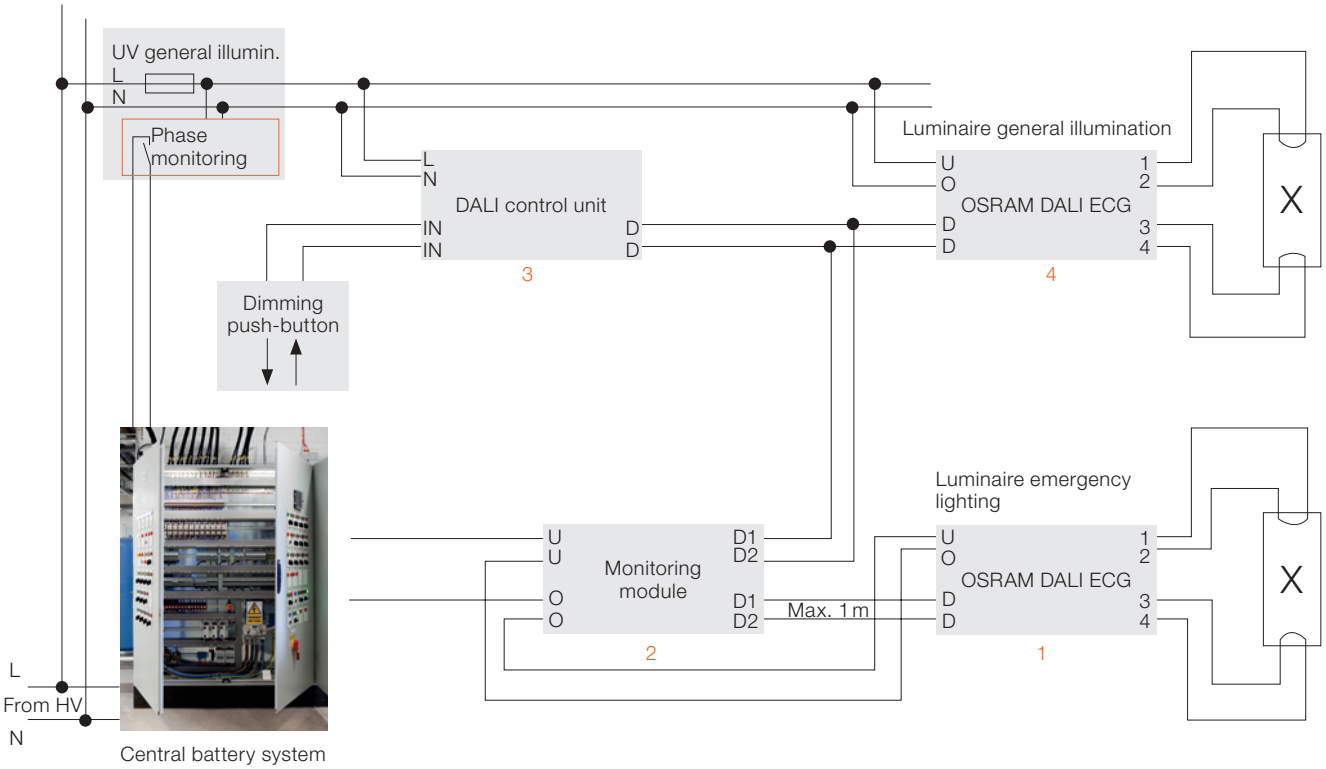
OSRAM ECG data for emergency lighting operation

Max. start time of the lamp	0.6 s
Permissible voltage range (DC)	154…276 V
Min. voltage for lamp start (DC)	198 V
Permissible voltage range (AC)	198…264 V
Mains frequency	0, 50…60 Hz

* The DALI or dimming function of the QTi DALI T5/T8 DIM ECGs is identical for AC and DC operation.

The use of OSRAM DALI control gears in emergency lighting management is illustrated in the following diagram.

Switching example monitoring module and OSRAM DALI ECG in emergency lighting management



The monitoring module (2) enables the individual monitoring and control of DALI ECGs (1).

The following applies for normal operation:
The OSRAM DALI ECG emergency lighting (1) is supplied with AC voltage via the central battery system. All control gears can be conventionally dimmed and are controlled by the DALI control unit (3). For maintenance functions (e.g. for service, switching by the maintenance supervisor), the OSRAM DALI ECG emergency lighting (1) can be switched via the monitoring module (2) to 100 %; the commands of the DALI control unit (3, e.g. dimmer setting) are ignored.

When switching the lighting system to emergency lighting operation, two cases must be differentiated:

4.3.1 Power failure in sub-distributor (SD) general illumination

According to DIN V VDE V 0108-100 and DIN EN 50172, if AC mains is connected to the central battery system (CB), the system may not be switched to battery during emergency operation; however, the safety lights (1) must be switched to continuous light. The external DALI control unit is ignored and the OSRAM DALI ECG emergency lighting (1) is dimmed to 100 % by the monitoring module (2) via a DALI command set.

4.3.2 DC emergency lighting operation in the event of power failure in the main distributor (MD) → battery operation

The central battery system (CB) provides the DC supply voltage. The external DALI control unit (3) is ignored and the ECG is set by the monitoring module (2), which is DC-capable, to a previously defined value via a DALI command set. The emergency lighting level is specified. OSRAM DALI ECGs (1) can communicate via DALI when applying a DC power supply and are, therefore, individually dimmable.

4.3.3 DC emergency lighting operation without additional external monitoring module (e.g.: CEAG 2L-CG-SB) by shutting down the DALI control units

The DALI control unit (3) is switched off when converting to the emergency lighting operation; the DALI control gears (4) detect that the “system failure level” is set because the DALI voltage (approx. 16 V DC which are always applied to the terminals of the DALI control gears) is not available.

Note:
The “system failure level” takes priority over the “power-on level”. In other words, if the DALI voltage is missing when applying the mains voltage to the ECG, the “system failure level” is set as a result. The “system failure level” can be individually set for each ECG – from 0…100 % light.

4.3.4 Advantages of OSRAM DALI control gears in emergency lighting applications:

- Unrestricted DALI communication with the ECG, even during emergency lighting operation
- Luminous flux ratio in battery operation can be freely set; meaning it can be adjusted to the lighting situation
- Efficient use of the battery capacity through reduced luminous flux setting
- Simple installation in the luminaire
- It is possible to use DALI ECGs as emergency lighting ECGs with freely parameterizable reduction of the light value, even without bus

4.4 OSRAM DALI magic and OSRAM DALI Wizard

The DALI magic interface offers the following options with the OSRAM DALI Wizard software:

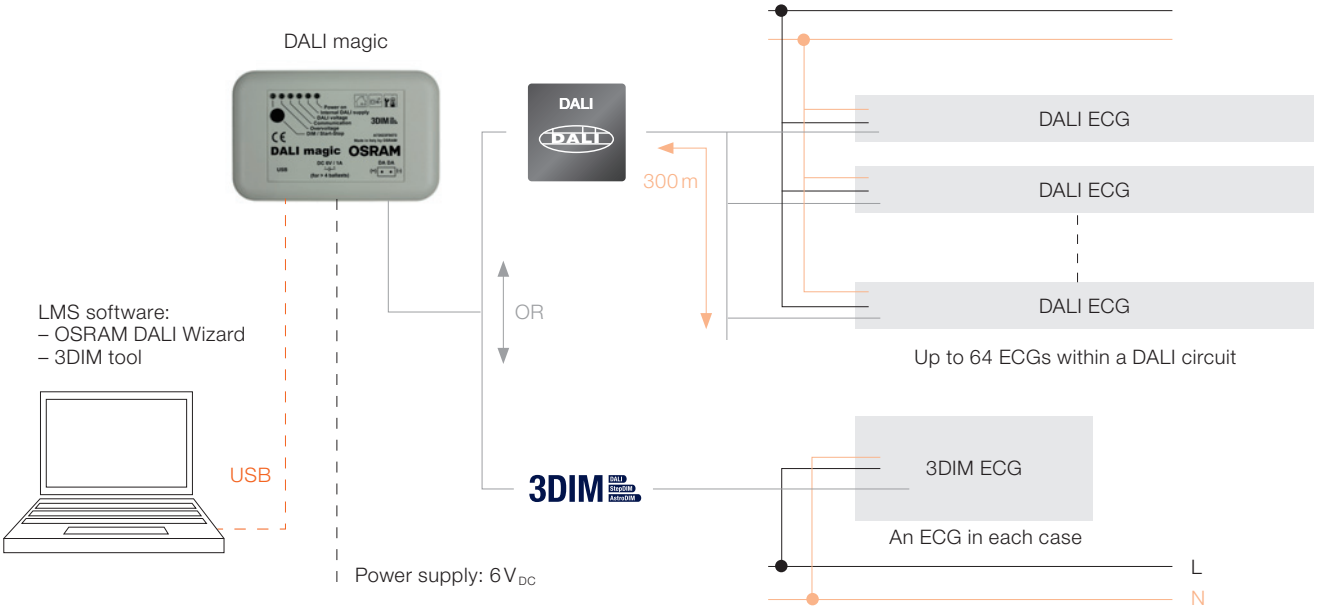
- Easy diagnosis/analysis/parameterization of DALI installations
- Quick location of addressing/programming errors
- Easy programming of OSRAM QTi DALI ECGs
- New: Corridor and Touch DIM configuration tool: Setting of dimming/light ranges and fade-out times
- New: Emergency lighting function: DC detection, DC light value setting etc.
- New: POWER2LAMP function: Optimized operation of T5 Energy Saver/standard lamps via flag

DALI magic EAN40 (1 unit): 4052899039551
Software download: http://www.osram.com/osram_com/tools-and-services/tools/dali-magic/index.jsp

DALI magic programming device

Dimensions [mm] 120 x 79 x 28

DALI magic: Connections



4.5 Basic circuits in 1...10-V control gears

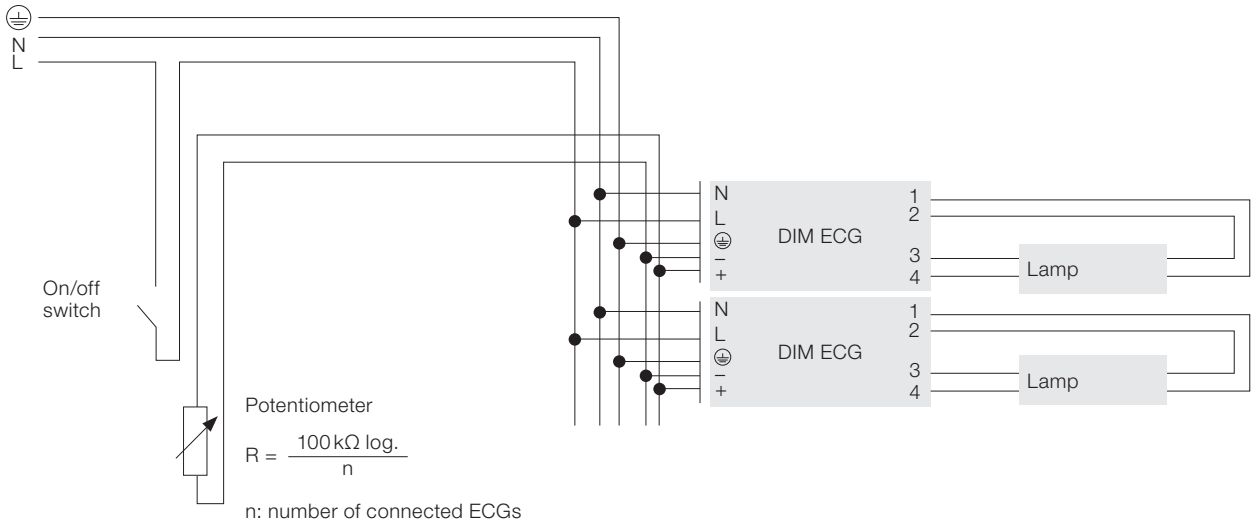
The simplest type of light management system can be executed via a corresponding logarithmically dimensioned potentiometer (available from electrical retailers). As the control power of the OSRAM DIM ECG is produced by the ECG itself, the resistance value depends on the number n of connected ECGs. It is calculated according to the following formula:

$$R_{Poti} = \frac{100k\Omega \log}{n}$$

If the calculated value is not included in the resistance table, a similar value should be selected, because otherwise full modulation of the lamps is not possible (this overdimensioning may lead to the entire rotation angle of the potentiometer not being utilized for brightness control). The potentiometer must be designed for power of $P_{Poti} = 2{,}8mW \cdot n$ at least.

An additional mains switch is required for switching the lighting installation. When connecting the potentiometer, it must be ensured that the full lighting level is achieved by turning to the right. The use of a DIM MCU (manual control unit) is recommended when connecting more than two OSRAM DIM ECGs. The relevant documentation (user instructions, LMS portfolio) contains detailed information on this. The following diagram illustrates the control using a potentiometer:

Potentiometer control of the 1...10-V interface



4.5.1 "Standby" operating modes with the 1...10-V interface

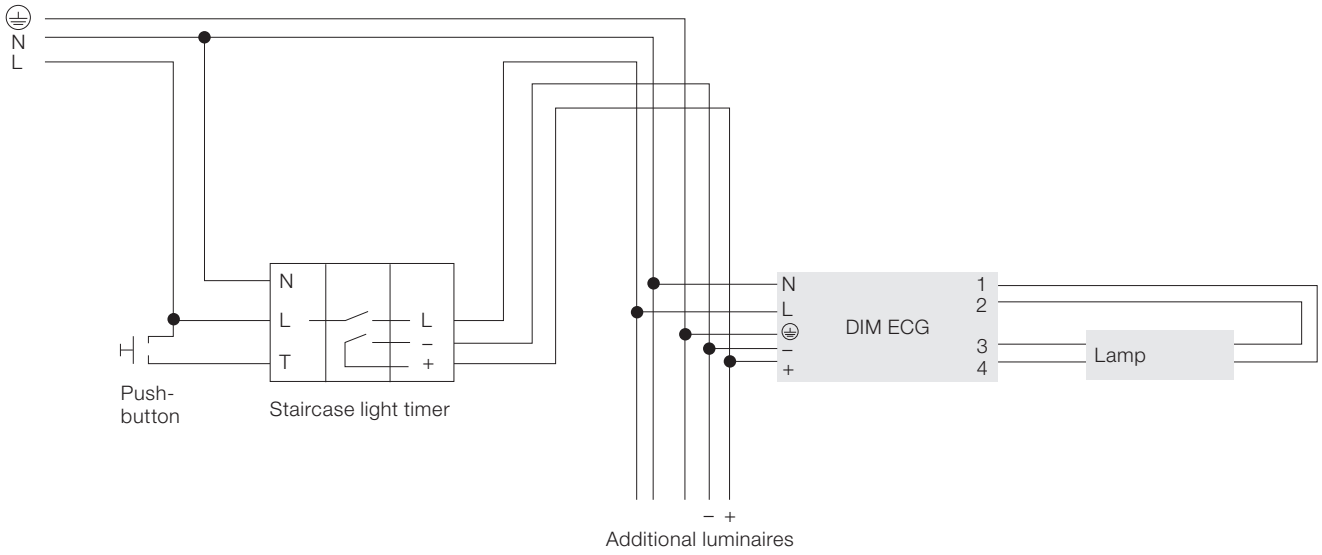
OSRAM DIM ECGs dim the light down in standby mode (1 % luminous flux) when it is not needed. This avoids unnecessary switching processes and saves energy. Additional advantages of standby switching: As the light is not completely switched off, a certain amount always remains as an orientation light. If needed, a large amount of light is immediately there without having to wait for a preheating time. Typical applications for standby switching are all applications with high switching frequency, such as the stairwell, corridor or basement garage, particularly if the light is controlled by a motion sensor or timer.

4.5.1.1 Applications

a) "Standby switching" with staircase light timer

A special staircase light timer (e. g. Siemens: Type 5TT1 303) is responsible for standby switching of the OSRAM DIM ECG. Operating principle: When the push-button is pressed, the staircase light timer switches on the OSRAM DIM ECG (100 % light). After max. 10 min (time is adjustable), the light sinks to a preselectable level without intermediate stages. Shutdown completes after a total of 30 min. This 30-minute cycle is started again at any time by pressing the push-button. The lamp-friendly standby operation shows its worth in the evening hours when the stairwells are highly frequented. The light changes only between the dimmer settings; real switchings are rare. Overnight, when the staircase light is not needed for a long period, the remaining power consumption can also be saved in the lowest dimmer setting.

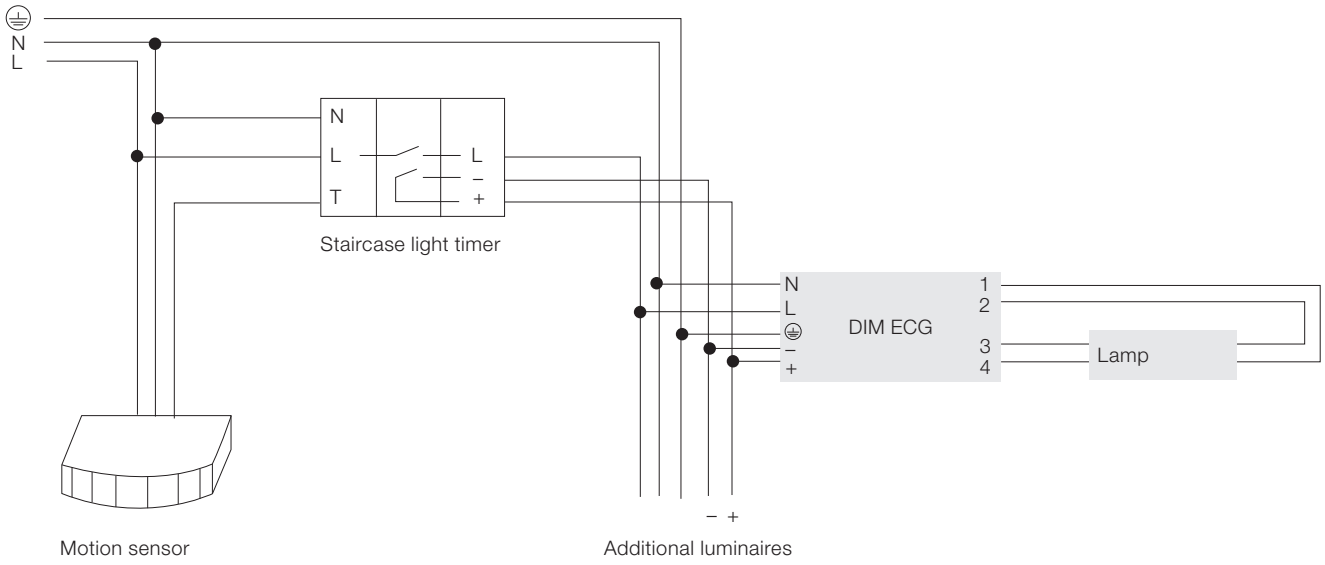
Standby switching with staircase light timer



b) “Standby switching” with staircase light timer and motion sensor

As the push-button switches on the mains voltage (L), it can be replaced by a motion sensor. Parallel switching with the push-button is also possible. Because the switch-on time is set on the staircase light timer, the switch-on time of the motion sensor can and should be set to a minimum.

Standby switching with staircase light timer and motion sensor



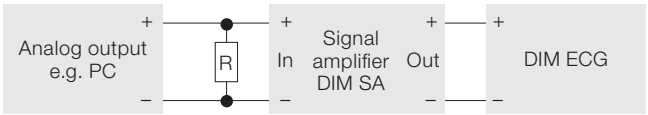
4.5.1.2 Control via analog output

The external control with an analog output 0…10 V (e. g. PC card) is possible, in principle. This control module must be in the position to absorb the current delivered by the ECG in the control line and to minimize the control voltage to at least 1 V. In order to do this, however, the analog output must fulfill two requirements: It must be floating; therefore, it must not be galvanically connected to accessible parts or switchings which are subject to SELV requirements (test voltage 2500 V, the test voltage to earthed parts is 1500 V). The analog output must be able to work as a current sink, since it must absorb the control current of the OSRAM DIM ECG. In most cases, it is unknown whether and how much current an analog output can absorb; however, you can always manage with a matching circuit.

4.5.1.3 Matching circuit

With up to three OSRAM DIM ECGs, connecting the control inputs of the ECG directly with the analog output is recommended; with four or more OSRAM DIM ECGs, a signal amplifier should be interconnected. Next, start the system, set the control voltage to 0 V and check directly at the analog output with a multimeter. If the measurement value is below 1 V, the system can be brought online. If the control voltage is higher than 1 V, the analog output can not absorb enough current and an additional current sink is required in the form of a resistor R switched in parallel. The required value is determined as follows: In the case of a 0-V control voltage specification, a potentiometer (approx. 5 kΩ linear) is also set to the analog output and, therefore, a 1-V control voltage is set. Disconnect potentiometer and measure the resistance value (must be larger than 680 Ω), provide and connect the corresponding fixed resistor (design 0207, capacity 0.25 W, possibly the next smallest resistance value).

Control via PC



4.5.1.4 Control via KNX

Dimmable ECGs with 1…10-V interface easily integrate into installations with KNX. The connecting link between KNX and the dimmable lighting installation is a switch/dimming actuator. A switch/dimming actuator is required for each lighting group. The digital bus signal is utilized by the switch/dimming actuator in the analog 1…10-V control voltage for OSRAM DIM ECGs. The ECG is switched on/off using an integrated relay contact. Various functions are parameterizable: On, off, brighter, darker, as well as specifying a defined control voltage. Sensors for daylight control etc. are normally connected to the KNX level. Detailed information can be obtained from the manufacturer of the KNX.

4.6 Special circuit diagrams, tips and tricks for the 1…10-V interface

4.6.1 Temperature-dependent control

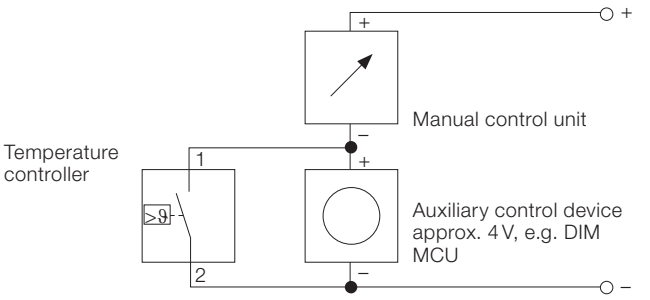
In case of temperature problems in dimmed fluorescent lamps, the dimmer setting can be restricted to a lower level depending on the temperature.

Note

Information about the minimum permissible dimmer settings at low temperatures (< 10 °C) depending on the type of lamp is found in the sections “Temperature behavior” (see point 3.8) and “Dimming amalgam lamps” (see point 4.9).

The stability limit (stable dimming operation at low temperatures (< 10 °C)) depends greatly on lamp tolerances. The temperature limit may be lower in control modes that start the lamp at 100 % (e.g. standby switching). Therefore, the response temperature as well as the control voltage should be adjustable with an automatic controller. The following switching is suggested:

Temperature-dependent control



The temperature controller can, for example, be a room temperature controller for a heating control system. The switching temperature (e.g. 0 °) should be accurately adjustable if possible. The switch must be an NO contact, i.e. closed at high temperatures. Such devices are offered with bimetal contact (e.g. 2NR9 090-1, power supply not required) or with temperature sensors (e.g. 2NR9 078, power supply required). Possibly existing heating resistors for thermal feedback (TR) or night-time power reduction are not connected (in deviation from the attached circuit diagram!). The only mains connection is the power supply which may be required. Different types of protection are necessary, depending on the application. Additional details are available from qualified personnel for heating and air-conditioning units.

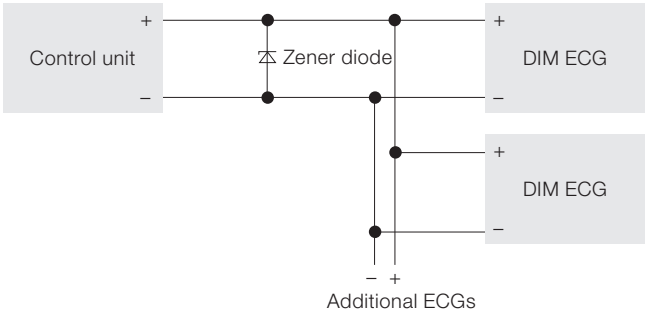
4.6.2 Limiting top and bottom control voltage

Limiting the top and bottom control voltage for the OSRAM DIM ECGs is required for certain applications. Reasons for this may be, for example, special lamp/ECG combinations or flickering occurrences at lower temperatures.

a) Upper limitation

The easiest way to achieve this is parallel switching of a Zener diode with the corresponding value. A Zener diode with a nominal value of 7 V must be used when limiting, for example, to 7 V. Model Bzx 55C xVx can be recommended. For xVx, for example, 7V5 equals 7.5 V. At least 20 ECGs can be controlled with this model. In principle, the control unit with the lowest value sets the specification for the OSRAM DIM ECG when running parallel switching for multiple control units. This applies to all passive control units, i. e. devices which represent a current sink.

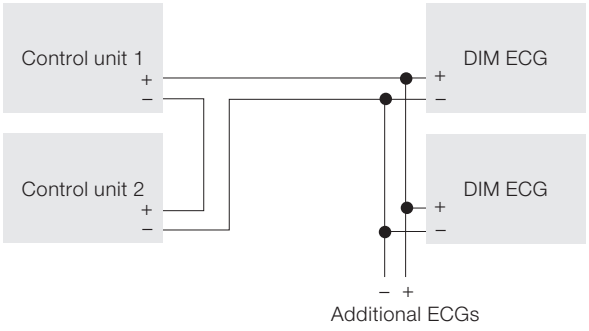
Limiting top control voltage



b) Lower limitation

An effective lower limitation can be achieved through serial switching of two control units. The sum of both devices is effective. With one device, the control voltage specification of the other device cannot be exceeded. Caution: The smallest achievable control voltage amounts to approx. 2 V (c. 4 % luminous flux) when serially switching two control units. The connections are to be made according to the sketch.

Limiting bottom control voltage



4.6.3 Line length of the 1…10-V control line

The control line lengths are only limited by a drop in the voltage. Overall, it can be said that a 100-m line length is generally noncritical. The following formula can be used for a more precise estimation:

e. g. at 1.5 mm², lighting strip, feed-in to start:

L_{max} = 35 km/number of ECGs
= 350 m with 100 ECGs
= 700 m with 50 ECGs

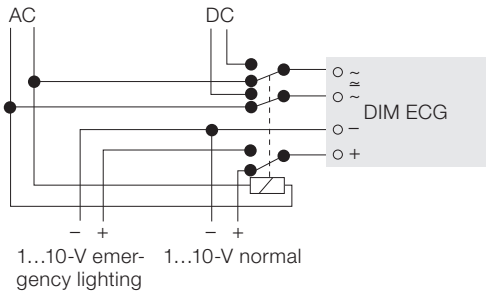
Any line length may be used with DIM SA signal amplifiers.

4.6.4 1…10-V DIM ECGs and emergency lighting

Dimmable 1…10-V QUICKTRONIC® ECGs are suitable for emergency lighting systems according to DIN V VDE V 0108-100 and DIN EN 50172. When using dimmable 1…10-V QUICKTRONIC® ECGs in emergency lighting systems, the control line should be disrupted in emergency operation by suitable measures at the positive terminal. Corresponding easy-to-wire toggle converters are available on the market which send an adjustable control voltage to the OSRAM DIM ECG, thus enabling battery-friendly emergency lighting operation at less than 100 % luminous flux.

Emergency lighting with OSRAM 1…10-V DIM ECGs

Switching from AC to DC (incl. plus terminal)



Some accessory components (e. g. DIM SA, DIM ICM 10 signal amplifiers) are not approved for battery operation. Therefore, it must be ensured that these components are never switched to a DC source. The signal amplifier, for example, represents in this case a fixed resistor which is connected to the control line. The dimmer setting of an ECG is then about 20 %, and higher with more ECGs.

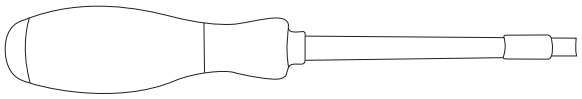
4.7 Terminals/cable cross sections/insulation stripping length

Both single-core wires and flexible ones are permissible for combination terminals for T5 and T8 fluorescent lamps used in the QTi DALI/DIM. The terminal can be contacted above via a so-called IDC (insulation displacement connector) and below via a plug contact (wire stripping 8.5–11 mm). For ECGs with plug terminals (HF DIM, QTi T/E DALI/DIM), both single-core wires (wire stripping 8.5–9.5 mm) and flexible ones are permissible, provided they are zinc-plated, sound-welded or equipped with wire-end ferrules.

4.7.1 Pressing in and loosening the connection cables

Manual contact of the insulation displacement termination (above) with the insertion tool, e.g. order number: WAGO 206-831

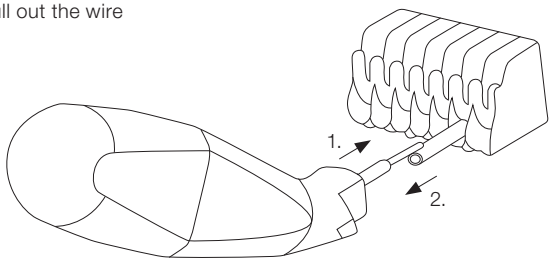
Wago insertion tool



Loosen the plug contacts (below) with the WAGO 206-830 extraction tool.

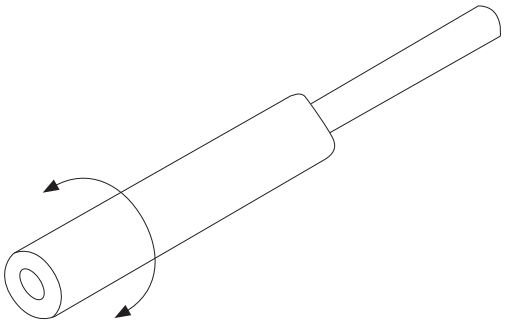
Wago extraction tool

1. Insert the extraction tool above the wire into the wire entry point
2. Pull out the wire



Alternatively, the plug contact can be extracted by simultaneously turning and pulling.

Loosening the plug contact



Information about wire stripping and cable cross sections are printed on the device.

4.7.2 Cable cross sections

Typical cable cross sections of pin and insulation displacement connectors (IDCs)

	Single-strand wire	Multi-strand wire
IDC (insulation displacement connector)	max. 0.5 mm²	max. 0,75 mm²
Plug contact	0.5…1.0 mm²	0.5…1.0 mm² (with wire-end ferrule)
Plug terminal	0.5…1.5 mm²	0.5…1.5 mm² (with wire-end ferrule)

4.7.3 Basic insulation

The IEC 61347 requires basic insulation for control inputs between the control circuit and mains. The DALI standard (IEC 62386) references this. Thus, the DALI line has “only” basic insulation and must, therefore, be treated like a mains voltage. The same is true of the 1…10-V interface.

4.7.4 Sockets

The lamps must fit tightly and make contact in the lamp sockets. The sockets must be selected depending on the ECG/type of lamp used.

4.7.5 Master/slave circuit

Additional wiring of the lamp cable to the next luminaire. Master/slave operation is not allowed with multi-lamp dimming devices. The reason for this are capacitive leakage currents, which can lead to asymmetries, differing luminances and instable dimming operation (flickering).

4.7.6 Minimum reflector distances

The reflector may never rest against to the lamp as this may otherwise cause vibrations and noise. In all luminaires, a minimum distance of 6 mm must be maintained between the lamp and the reflector and other luminaire parts. If the distance is shorter, uneven brightness can occur along the lamp due to capacitive leakage currents. Flickering can also occur. Moreover, lamp parts which touch the bulbs can lead to mercury bonds in the lamps.

4.8 Temperature behavior of dimmable ECGs from OSRAM

Permissible guideline values for minimum luminaire ambient temperatures

Type of lamp	Min. temperature with1 % (3 % CFL) dimmer setting	Min. dimmer setting at -20 °C to +10 °C
T8/26-mm lamp***	-20 °C*	1 %*
T5/16-mm lamp*	+10 °C	
HE 14…35		60 %****
HO 49		50 %
HO 24…80		30 %
DULUX L*	+10 °C	30 %
DULUX D/E, T/E, FC	+10 °C**	50 %

* Only with QTi…DIM

** Only with 3…100 %

*** Only with L18W, L36W, L58W, not L70W

**** The critical point from which the burn voltage increases excessively in the cold is just below the 30-% dimmer setting for T5-HO lamps. This point is achieved with the same power density in T5-HE lamps. In this case, however, the dimmer setting is 60 % due to the power of 100 % only being half as high. The T5 HO 49 W is between T5 HE 14…35 W and T5 HO 24…80 W. Dimming of amalgam lamps T5 HO CONSTANT (HO 24 W, HO 39W, HO 54 W, HO 80 W), CFL (DULUX® L CONSTANT 40 W, 55 W, 80 W and DULUX® T/E CONSTANT 26 W, 32 W, 42 W) possible.

The temperature range can be expanded downwards by raising the lowest dimmer setting until the luminaire has reached a higher internal temperature; otherwise, flickering and/or start problems are to be expected.

4.8.1 Intelligent thermal management allows operation in a wide ambient temperature range through power reduction control

Starting with the generation at the end of 2008, QTi DALI/DIM ECGs from OSRAM are classified as intelligent temperature controllers.

Properties

- Significant increase of luminous efficacy (lm/W) in hot luminaires
- Virtually no loss of luminous flux (lm) compared to uncontrolled operation
- No reduction of the ECG lifetime within the control range
- Simplifies the safety approval for hot luminaires
- Relieves luminaire components

Note

- Limits the t_c temperature to < 80 °C (depending on the installation conditions), however, the ECG never switches off as a result of overtemperature due to power reduction control.
- Even with these ECGs, thermally problematic luminaires are not necessarily made into standard-compliant units.
- Power reduction control occurs at up to 70 % of the full load operation.
- The degree of efficiency of a hot luminaire is always lower than that of a thermally optimized luminaire.

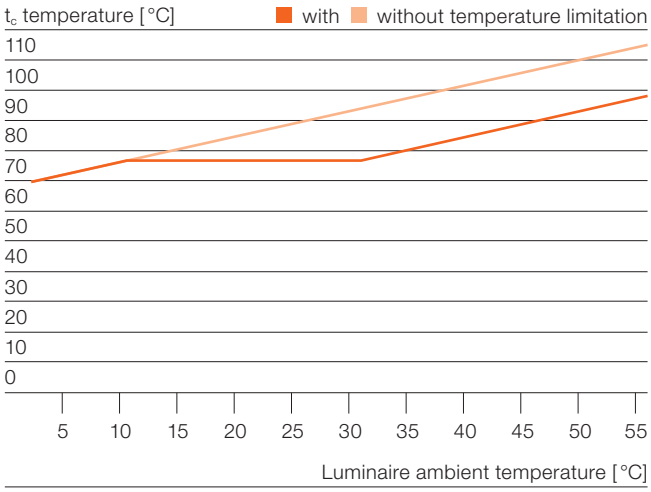
Operating principle

The ECG measures the ECG temperature 1 x per minute. With the set temperature limit, it starts reducing the power to decrease the luminaire temperature and stop the ECG temperature from increasing any further. The t_c temperature is between 75 °C and 80 °C, depending on the installation conditions (e.g. heat coupling into the ECG from above or below). With an ambient temperature of 25 °C, even in hot luminaires, a reduction of the system power by 10 %–0 % is usually enough, but only approx. 1 %–2 % light is lost because the efficiency of the system increases.

Dimming is possible at any time, however, the temperature limitation represents a temperature-dependent upper limit to the dimming range.

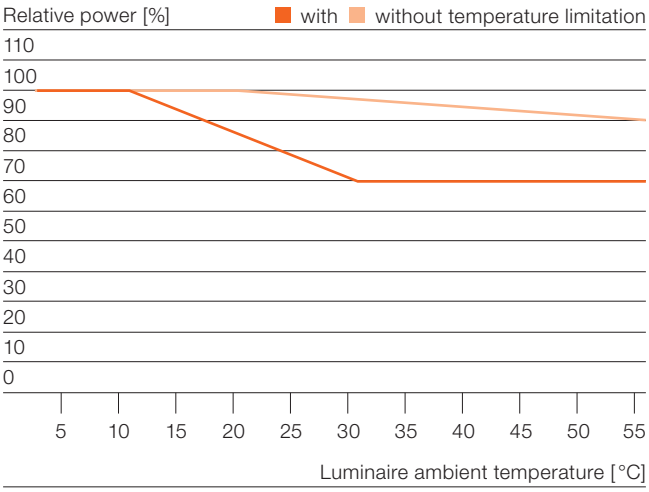
The reduction of the lamp wattage compensates the loss of luminous efficacy in hot luminaires through improved efficiency in the lamps.

Temperature at the t_c measuring point as a function of luminaire ambient temperature



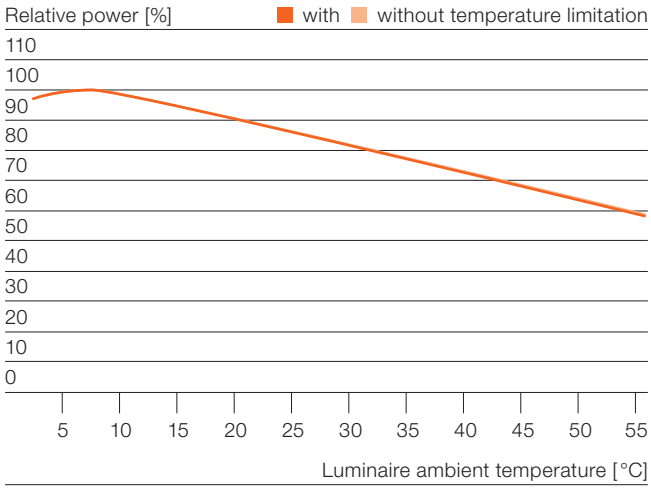
Dimmable QTi ECGs from OSRAM hold their temperature constant at the t_c measuring point within a wide range and, therefore, also the temperature in the luminaire. As a result, the ECG components, as well as all other luminaire components, are relieved.

Relative power as a function of luminaire ambient temperature



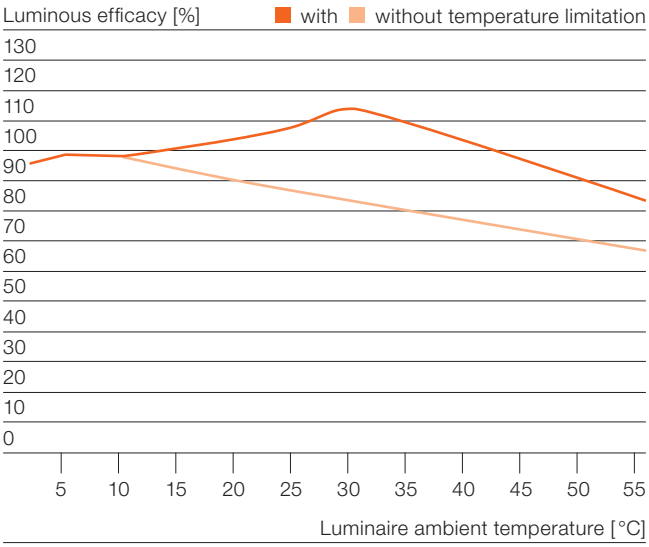
This is achieved through a reduction of the system power.

Relative power as a function of luminaire ambient temperature



Despite this, the luminous flux of the luminaire rarely decreases because the efficiency of the system increases through power reduction control.

Luminous efficacy as a function of luminaire ambient temperature



The clear increase in the system's relative luminous efficacy shows that the temperature limitation has an energetically positive effect on hot luminaires.

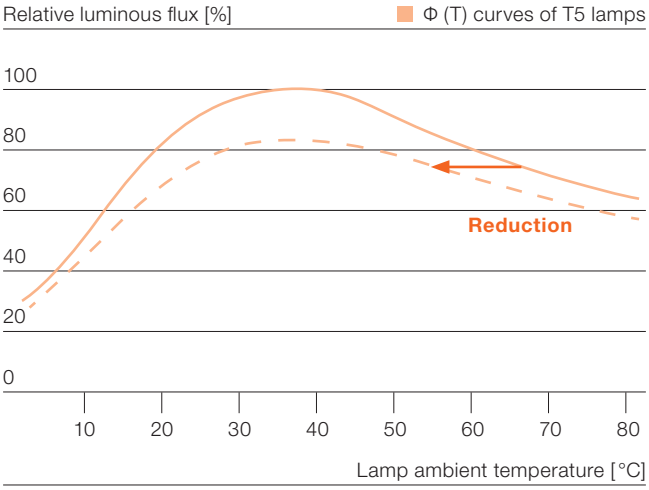
Example: Tight 2-x-80-W-T5 luminaire
(applies for luminaires with direct heat feedback)

The exact scaling depends on the luminaire type and the ECG installation conditions.

Why is hardly any light lost through the temperature limitation?

Let's assume we have a luminaire with an internal temperature, i.e. the lamp ambient temperature, that should be lowered from 65 °C to 55 °C. A reduction of the system power by 20 % is required for this purpose. The diagram shows the Φ(T) curves of T5 lamps for 100 % system power and, according to the power reduction of 20 %, for 80 % system power. When transitioning from the 100-% curve to the 80-% curve and the resulting reduction in the temperature of 10 °C, the luminous flux remains nearly the same.

Reduction and relative luminous flux

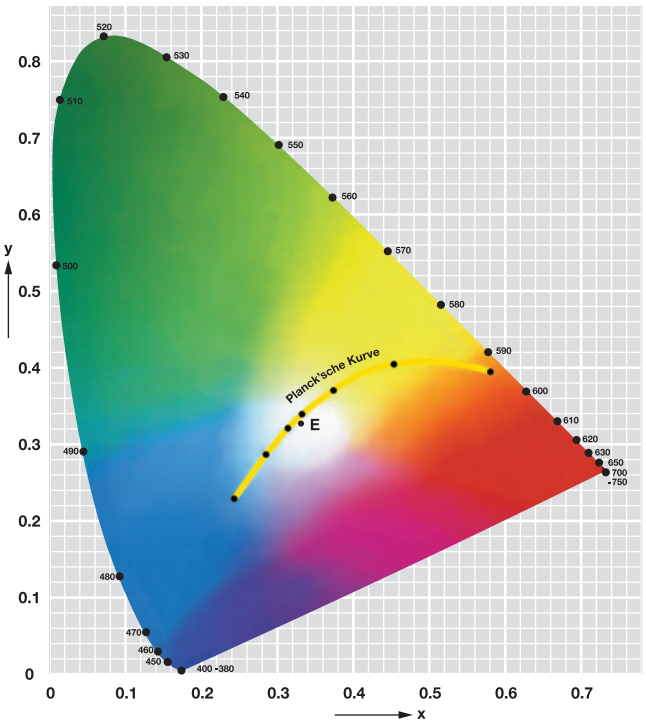


4.8.2 Color temperature

The color temperature of the lamp changes between the maximum and minimum luminous flux of the lamp – in the case of the DULUX L, this is approx. 150 Kelvin. Visually, the color difference looks much greater due to the huge difference in light density. This means that the subjective perception of the human eye does not reflect the objective color temperature change. Directly after switching from maximum to minimum luminous flux, a short color shift of up to 400 Kelvin occurs (shift to red section, see diagram top right) that is reduced after approx. 30–40 minutes to the aforementioned color difference (stabilization phase).

Note:

Standard color table according to DIN 5033



The measurement of the most similar color temperature in the case of strongly dimmed lamps makes the highest demands of the electronics and the receiver of the colorimeter. Erroneous evaluations with standard colorimeters can not be ruled out.

4.8.3 Outdoor applications

For outdoor applications, a special OSRAM housing, the “OUTKIT”, is available for protecting the ECG against moisture. It is available for ECGs with a total height of 30 mm or 21 mm and lengths of 360 mm and 423 mm.
Details can be found in the current light program. For outdoor applications, the temperature range of the system lamp/ECG should be carefully considered. Sufficient mains quality (above all, lightning protection) must be available for all outdoor applications, so that the ECGs are not damaged.

4.8.4 Functional testing for luminaires

The dimmable OSRAM QTi family (DALI and 1…10 V) outputs the following power per lamp in the luminaire test (with 10-Ω substitute resistors):
1/2 lamps (T5 and T8): 32 watts
3/4 lamps (T5 and T8): 16 watts

This function does not depend on the application of the real lamp. The filament detection can be switched off for special applications/luminaires – details upon request.

If the final luminaire test is executed in Touch DIM operation, it must be ensured that the lamp is dimmed to 10 % before disconnecting the luminaire from the mains. This is the only way to ensure that the light can also be switched on with the fuse (without control unit) while installing the

luminaire, as it is defined with DALI. If the luminaire has been switched off via Touch DIM, the luminaire remains out even after a disruption of the voltage – the installer may incorrectly assume a defective ECG in this case.

When the luminaire is connected to the mains voltage for the first time (without control unit), it must switch on with 100 % luminous flux (= DALI factory setting). Switiching from DALI to Touch DIM operation or vice versa presumes a power voltage disruption to the ECG (safety interlock).

4.9 Dimming amalgam lamps with OSRAM ECGs

With the newest device generation of OSRAM QTi DALI/DIM, the following families of amalgam lamps are also dimmable:

Properties

- Stable dimming operation up to 1 % (KLL 3 %)
- Extremely high luminous flux in a wide ambient temperature range
- 90 % luminous flux of 0 °C to +70 °C (temperature-dependent “cut-off”)
- Reliable ignition up to -20 °C
- “Power Boost” stabilizes discharge in the “pink phase”
- No shortening of the lifetime of lamp/ECG

Lamp/ECG combinations

- T5: HO CONSTANT: 24 W, 39 W, 54 W, 80 W
  Dimming range: 1…100 %
- CFL: DULUX L CONSTANT 40 W, 55 W, 80 W
  Dimming range: 1…100 %
- CFL: DULUX T/E CONSTANT 26 W, 32 W, 42 W
  Dimming range: 3…100 %

Dimming amalgam lamps: Lamp/ECG combinations

ECG \ Lamp	HO 24 W CONSTANT (T5)	HO 39 W CONSTANT (T5)	HO 54 W CONSTANT (T5)	HO 80 W CONSTANT (T5)	DL CONSTANT 40 W (KLL)	DL CONSTANT 55 W (KLL)	DL CONSTANT 80 W (KLL)	D T/E CONSTANT 26 W (KLL)	D T/E CONSTANT 32 W (KLL)	D T/E CONSTANT 42 W (KLL)
QTi DALI/QTi (1…10 V) 1x14/24 DIM	x									
QTi DALI/QTi (1…10 V) 1x21/39 DIM		x			x					
QTi DALI/QTi (1…10 V) 1x28/54 DIM			x			x				
QTi DALI/QTi (1…10 V) 1x35/49/80 DIM				x			*)			
QTi DALI/QTi (1…10 V) 2x14/24 DIM	x									
QTi DALI/QTi (1…10 V) 2x21/39 DIM		x			x					
QTi DALI/QTi (1…10 V) 2x28/54 DIM			x			x				
QTi DALI/QTi (1…10 V) 2x35/49/80 DIM				x			*)			
QTi DALI/QTi (1…10 V) 3x14/24 DIM	x									
QTi DALI/QTi (1…10 V) 4x14/24 DIM	x									
QTi DALI/QTi (1…10 V) - T/E 1x18-57 DIM								x	x	x
QTi DALI/QTi (1…10 V) - T/E 2x18-42 DIM								x	x	x

* Not for flashing operation, can only be operated in the context of a special concession

4.9.1 Falling below the min. dimmer setting at low temperatures

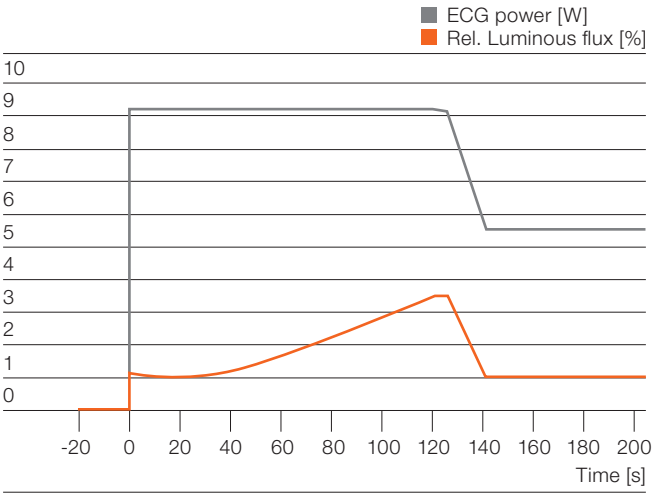
QTi DALI/DIM operating principle: “Power Boost” and amalgam lamps

The amalgam releases as much mercury as needed for the discharge and, as a result, minimizes the drop in luminous flux in hot or cold temperatures. After a change to the operational mode, however, it takes a few minutes until the mercury balance is readjusted. If the lamp is switched off for a longer period of time – no discharge and no mercury needed – the amalgam collects all of the mercury. The mercury deficiency occurs with a new start, recognizable by the “pink phase”.

If the lamp is dimmed at this point, its voltage can rise and the discharge can become unstable. This is where the “Power Boost” of the QTi DALI/DIM comes into play: It automatically increases the lamp wattage in order to reduce the voltage and to stabilize discharge. When the amalgam has then released enough mercury through the resulting warming, the output is automatically reduced again and the lamp remains stable while being dimmed.

The “Power Boost” also works with standard lamps: At extremely low temperatures, it automatically increases the lamp wattage as needed and always enables stable, flicker-free operation.

“Power Boost” and lamp start with HO-CONSTANT 24-W lamp



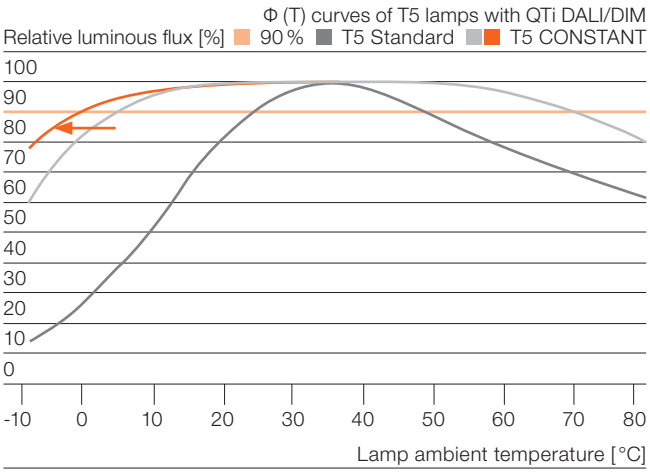
QTi DALI/DIM operating principle with CONSTANT lamps: Relative luminous flux > 90 % over additionally expanded temperature range of 0 °C to 70 °C.

Standard T5 lamps reach their luminous flux optimum at an ambient temperature of 35 °C – but only if the mercury balance is not influenced by the additional electrode heating. The QTi-DALI/DIM devices, therefore, have a “cut-off”; i.e. they switch off the electrode heating when it is not needed.

It is clear that amalgam lamps put out more light at lower ambient temperatures when the electrodes are heated slightly. At high temperatures however, this effect is reversed.

The QTi DALI/DIM uses its internal temperature sensor to switch off the electrode heating only when the temperature is high enough. This allows an additional increase in the luminous flux in cold amalgam lamps: The temperature at which the luminous flux falls below the 90-% line falls from 5 °C to 0 °C.

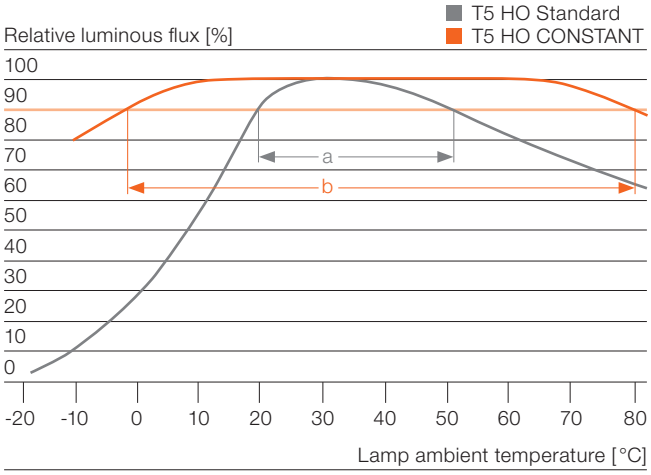
QTi DALI/DIM: Extremely high luminous flux over an expanded temperature range



4.9.2 The advantages of amalgam technology

Note:
Dimming amalgam lamps is also suitable for outdoor applications. It must be ensured that the ECG is sufficiently protected from external influences (IP67).

Relative luminous flux vs. ambient temperature in the luminaire of T5 HO Standard and T5 HO CONSTANT lamps



The expanded temperature range of the new OSRAM T5 HO CONSTANT (b) compared to the T5 HO Standard (a).

More light from new luminaires thanks to amalgam technology

- High-wattage downlights

Up to 20 % more light

- High-wattage floor-standing luminaires
- Street luminaires with DL 55 W
- Handrail luminaires

Up to 20 % more light

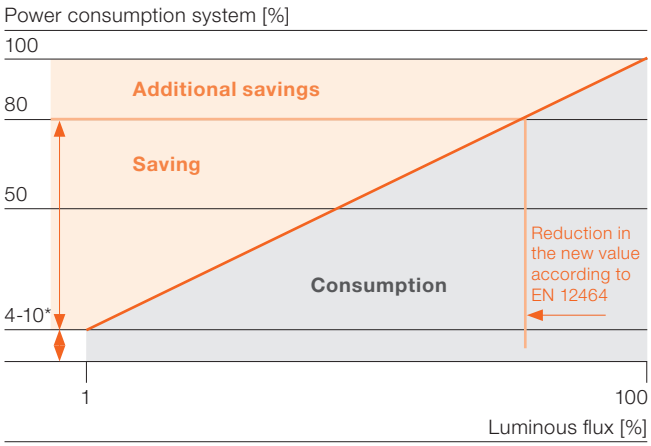
- Tunnel lighting
- Wallwashers for outdoor areas
- High-wattage, tight office luminaires
- Hall lighting
- Parking garage luminaires
- Refrigerated display cases

Up to 30 % more light

5 System power consumption and dimmer setting

Because a primarily linear correlation exists between the power consumption of the DALI/DIM systems (lamp and ECG) and the dimmer setting, the power consumption PN(d) can be calculated for every dimmer setting d from the values PN10 % (rated power 100 %, PN = “power nominal”) and PN % (rated power 1 %; depends on lamp ECG combination, available upon request):

Linear correlation: Dimmer setting and power consumption system



* 1/3 own consumption and 2/3 lamp heating

6 Dimming compact fluorescent lamps

Lamp variety with an ECG

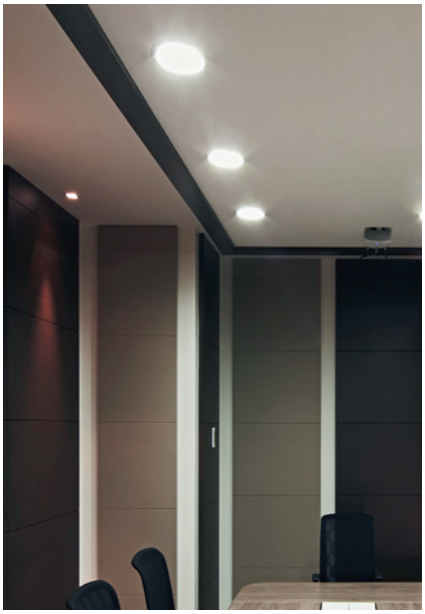
DULUX T/E 18 W and T/E 57 W can be operated on an ECG with the new KLL-MULTI-lamp ECGs. All 2-lamp downlights can be equipped for 2x18, 2x26, 2x32 and 2x42 W with a single 2-lamp DIM ECG. DALI/Touch DIM or Touch DIM sensor interfaces can be optionally ordered[13]. The user is able to continuously set the desired level of light by dimming.

The QTi T/E system

DALI MCU

Radio switches without battery

Radio receiver

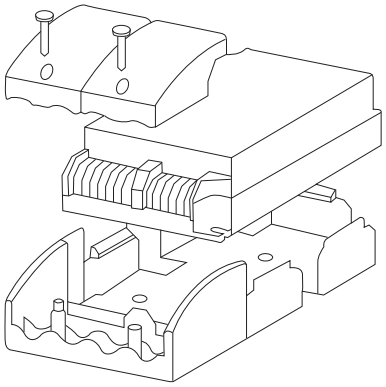


13) Operation is also possible with 1…10-V interface (QTi-T/E 1x18-57 DIM and QTi-T/E 2x18-42 DIM)

6.1 Characteristics of the OSRAM KLL ECGs

- The DULUX CONSTANT (amalgam) can also be operated on the DIM ECG
- Lamp start with optimized filament heating within 0.6 s
- 2-lamp ECG now as small as 1-lamp ECG (K3 housing)
- Dimming range 3…100 % luminous flux
- DALI and Touch DIM interfaces can be operated in an ECG, for example, on DALI dimmer or Touch DIM sensor
- Highest energy efficiency thanks to “cut-off” technology
- Automatic safety shutdown of lamps in the event of a defect or at end of life (EOL T2)
- Optional cable clamp for snap-in into housing

Principle of optional cable clamp for snapping into housing



Numerous applications can be covered in the downlight area with just one type of luminaire in combination with the new QTi-T/E-DALI/DIM generation from OSRAM. Therefore, it is possible, for example, to easily and flexibly design dimmable lighting for a building with different ceiling heights and varying luminaire installation locations (e.g. corridors, foyer etc.). Multiple “lumen packages” are possible per room. Thanks to optimized filament preheating, the lamp starts within 0.6 seconds. As a result, the user does not have to accept unnecessary waiting times after switching on.

The intelligent QTi-T/E-DALI/DIM devices automatically adapt the filament preheating at extremely low temperatures. This allows stable operation of amalgam lamps. Intelligent power reduction at excessive temperatures results in a longer lifetime and reliable operation.

QTi T/E 2x18-42W DALI/DIM: Achievable in a single luminaire

Numerous applications can be covered with a single type of luminaire …

- Dimmable lighting for a building with different ceiling heights and varying luminaire installation locations (e.g. corridors, foyer etc.) can be easily and flexibly designed.
- Multiple lumen packages are possible per room.

2x DULUX T/E 26 W | 2x DULUX T/E 32 W | 2x DULUX T/E 42 W

7 The DALI Group

The “Activity Group DALI” (AG DALI) was created in 1999 under the umbrella of the “Zentralverband der Elektroindustrie e.V.” (ZVEI) in order to establish this new standard on the market. In the meantime, the DALI Group has grown out of AG DALI. All leading ECG and control unit manufacturers are represented in this community so as to be able to develop and market their products in accordance with DALI requirements. The DALI Group is an open community which can be joined by anyone for a modest annual fee.

The DALI Group offers a “DALI manual” as well as additional informational brochures for download from their website. Visit: www.dali-ag.org

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Germany

Phone: +49 (0) 69 6302-0
Fax: +49 (0) 69 6302-317

8 Tender documents

QUICKTRONIC® Intelligent DALI DIM for compact fluorescent lamps

Order reference depending on the type of lamp:
QTi DALI T/E … DIM

- Intelligent ECG with DALI interface according to IEC 60929
- OSRAM DULUX® T/E 18, 26, 32, 42 W and OSRAM DULUX® compact fluorescent lamps
- T/E CONSTANT 26, 32, 42 W (amalgam lamps) with dimming from 3 % to 100 %
- Warm start of the lamp within 0.6 seconds without ignition flash
- Manual dimming operation (Touch DIM) without any control unit with standard installation push-button, incl. memory function (double-click) and soft start
- Lifetime: 80,000 h at t_c = 75 °C and a max. failure rate of 10 %
- Effective overtemperature protection of the DIM ECG through intelligent power reduction at high t_c temperatures
- 5-year System+ guarantee: There is a replacement for every ECG that fails due to a material or manufacturer defect, according to the conditions under www.osram.com/guarantee
- CELMA energy classification EEI = A1 BAT
- Highest energy efficiency thanks to cut-off technology
- EoL shutdown according to EN/IEC 61347-2-3, section 17
- For use in emergency lighting systems according to EN 50172/DIN VDE 0108-100
- Emergency power properties can be configured, light value can be set without control signal between 100 % and 3 % luminous flux.
- Quality marks: ENEC, VDE, EMV
- EN 60929, EN 61347-2-3, EN 55015, EN 61000-3-2, EN 61547, EN 61000-3-3

QUICKTRONIC® Intelligent DALI DIM for T5-Ø-16-mm fluorescent lamps

Order reference depending on the type of lamp:
QTi DALI … DIM

- Intelligent ECG with DALI interface according to IEC 60929
- Operation of T5-Ø-16-mm fluorescent lamps of the same length in a single luminaire to flexibly adjust the level of light
- Dimming from 1 % to 100 %
- Max. dimming speed for dynamic RGB color light application 5 ms, from 1 % to 100 % through optimized control of the filament heating
- Warm start of the lamp within 0.5 seconds without ignition flash
- Manual dimming operation (Touch DIM) without any control unit with standard installation push-button, incl. memory function (double-click) and soft start
- Lifetime: 80,000 h at t_c = 75 °C and a max. failure rate of 10 %
- Effective overtemperature protection of the DIM ECG through intelligent power reduction at high t_c temperatures
- 5-year System+ guarantee: There is a replacement for every ECG that fails due to a material or manufacturer defect, according to the conditions under www.osram.com/guarantee
- CELMA energy classification EEI = A1 BAT
- Highest energy efficiency thanks to cut-off technology
- EoL shutdown according to EN/IEC 61347-2-3, section 17
- For use in emergency lighting systems according to EN 50172/DIN VDE 0108-100
- Emergency power properties can be configured, light value can be set without control signal between 100 % and 1 % luminous flux.
- Quality marks: ENEC, VDE, EMV
- EN 60929, EN 61347-2-3, EN 55015, EN 61000-3-2, EN 61547, EN 61000-3-3

QUICKTRONIC® Intelligent DALI DIM for T8-Ø-26-mm fluorescent lamps

Order reference depending on the type of lamp:
QTi DALI … DIM

- Intelligent ECG with DALI interface according to IEC 60929
- Commercially-available T8-Ø-26-mm fluorescent lamps with dimming from 1 % to 100 %
- Max. dimming speed for dynamic RGB color light application 5 ms, from 1 % to 100 % through optimized control of the filament heating
- Warm start of the lamp within 0.5 seconds without ignition flash
- Manual dimming operation (Touch DIM) without any control unit with standard installation push-button, incl. memory function (double-click) and soft start
- Lifetime: 100,000 h at t_c = 75 °C and a max. failure rate of 10 %
- Effective overtemperature protection of the DIM ECG through intelligent power reduction at high t_c temperatures
- 5-year System+ guarantee: There is a replacement for every ECG that fails due to a material or manufacturer defect, according to the conditions under www.osram.com/guarantee
- CELMA energy classification EEI = A1 BAT
- Highest energy efficiency thanks to cut-off technology
- EoL shutdown according to EN/IEC 61347-2-3, section 17
- For use in emergency lighting systems according to EN 50172/DIN VDE 0108-100
- Emergency power properties can be configured, light value can be set without control signal between 100 % and 1 % luminous flux.
- Quality marks: ENEC, VDE, EMV
- EN 60929, EN 61347-2-3, EN 55015, EN 61000-3-2, EN 61547, EN 61000-3-3

QUICKTRONIC® Intelligent DIM (1…10 V) for compact fluorescent lamps

Order reference depending on the type of lamp:
QTi-T/E…DIM

- Intelligent ECG with 1…10-V interface according to IEC 60929
- OSRAM DULUX® T/E 18, 26, 32, 42 W and OSRAM DULUX® T/E CONSTANT 26, 32, 42 W compact fluorescent lamps (amalgam lamps) with dimming from 3 % to 100 %
- Warm start of the lamp within 0.6 seconds without ignition flash
- Lifetime: 80,000 h at t_c = 75 °C and a max. failure rate of 10 %
- Effective overtemperature protection of the DIM ECG through intelligent power reduction at high t_c temperatures
- 5-year System⁺ guarantee: There is a replacement for every ECG that fails due to a material or manufacturer defect, according to the conditions under www.osram.com/guarantee
- CELMA energy classification EEI = A1 BAT
- Highest energy efficiency thanks to cut-off technology
- EoL shutdown according to EN/IEC 61347-2-3, section 17
- For use in emergency lighting systems according to EN 50172/DIN VDE 0108-100
- Quality marks: ENEC, VDE, EMV
- EN 60929, EN 61347-2-3, EN 55015, EN 61000-3-2, EN 61547, EN 61000-3-3

QUICKTRONIC® Intelligent DIM (1…10 V) for T5-Ø-16-mm fluorescent lamps

Order reference depending on the type of lamp:
QTi … DIM

- Intelligent ECG with 1…10-V interface according to IEC 60929
- Operation of T5 fluorescent lamps of the same length in a single luminaire to flexibly adjust the level of light
- Dimming from 1 % to 100 %
- Max. dimming speed for dynamic RGB color light application 5 ms, from 1 % to 100 % through optimized control of the filament heating
- Warm start of the lamp within 0.5 seconds without ignition flash
- Manual dimming operation (Touch DIM) without any control unit with standard installation push-button, incl. memory function (double-click) and soft start
- Lifetime 80,000 h at t_c = 75 °C and a max. failure rate of 10 %
- 5-year System⁺ guarantee: There is a replacement for every ECG that fails due to a material or manufacturer defect, according to the conditions under www.osram.com/guarantee
- CELMA energy classification EEI = A1 BAT
- Highest energy efficiency thanks to cut-off technology
- EoL shutdown according to EN/IEC 61347-2-3, section 17
- For use in emergency lighting systems according to EN 50172/DIN VDE 0108-100
- Quality marks: ENEC, VDE, EMV
- EN 60929, EN 61347-2-3, EN 55015, EN 61000-3-2, EN 61547, EN 61000-3-3

QUICKTRONIC® Intelligent DIM (1…10 V) for T8-Ø-26-mm fluorescent lamps

Order reference depending on the type of lamp:
QTi … DIM

- Intelligent ECG with 1…10-V interface according to IEC 60929
- Commercially-available T8-Ø-26-mm fluorescent lamps with dimming from 1 % to 100 %
- Max. dimming speed for dynamic RGB color light application 5 ms, from 1 % to 100 % through optimized control of the filament heating
- Warm start of the lamp within 0.5 seconds without ignition flash
- Manual dimming operation (Touch DIM) without any control unit with standard installation push-button, incl. memory function (double-click) and soft start
- Lifetime: 100,000 h at t_c = 75 °C and a max. failure rate of 10 %
- 5-year System⁺ guarantee: There is a replacement for every ECG that fails due to a material or manufacturer defect, according to the conditions under www.osram.com/guarantee
- CELMA energy classification EEI = A1 BAT
- Highest energy efficiency thanks to cut-off technology
- EoL shutdown according to EN/IEC 61347-2-3, section 17
- For use in emergency lighting systems according to EN 50172/DIN VDE 0108-100
- Quality marks: ENEC, VDE, EMV
- EN 60929, EN 61347-2-3, EN 55015, EN 61000-3-2, EN 61547, EN 61000-3-3

9 Frequently asked questions (FAQ)

9.1 DALI part

9.1.1 Touch DIM and Corridor Function

— **Where are the Touch DIM and Corridor Functions found?**
Directly after switching on the ECG power supply: Activate the Corridor Function by permanently applying the supply voltage (220 V–240 V) to the DALI input of the ECG for at least 120 seconds (50 Hz) and 100 seconds (60 Hz), respectively. Touch DIM can be accessed by pressing and holding.

— **How do I navigate from the Corridor to the Touch DIM Function?**
Change from the Corridor Function to the Touch DIM Function by pressing a push-button 5 times (at the DALI input, 220 V-240 V) within 3 seconds.
Warning: Only individually tapping the push-buttons is accepted; double-clicks are ignored when changing operating modes.

— **May the Touch DIM Function and a DALI control unit be used simultaneously?**
No. Either a DALI control unit or the Touch DIM Function. Touch DIM and DALI operation cancel each other out.

— **How do the ECGs react after a power voltage disruption?**
QTi-series DALI ECGs automatically restart the previous state. The switching state (on/off) as well as the dimmer setting should be taken into account here.

— **Can devices which are not in sync be synchronized?**
Yes, implement the following sequence:
  — Hold the push-button pressed (> 3 s; all ECGs on)
  — Briefly press the push-button (all ECGs are switched off)
  — Hold the push-button pressed (all ECGs switch on in the lowest dimmer setting and dim up) ➔ Long-short-long

— **Can several DALI ECGs be attached to a single push-button?**
Up to 20 ECGs can be controlled by a push-button. Up to 64 DALI ECGs can be operated in the Touch DIM mode with a single DALI repeater.

— **What is the maximum permissible line length between the push-button and the ECG?**
Additional measures must be taken for lines longer than 25 m in order to suppress disruptions (e.g. bell transformer).

— **Which push-buttons may be used?**
Any push-button which is suitable for mains voltage may be used, however, not push-buttons with glow lamps.

— **Does Touch DIM only function with 230 V AC voltage?**
No, Touch DIM is possible from 10 V to 230 V (effective value!) AC voltage.

— **Can I also use DC voltage for Touch DIM?**
No, it must be AC voltage with a frequency between 48 and 63 Hz.

— **Can a Touch DIM system be upgraded with a DALI control unit?**
Yes, an upgrade is possible at any time. The transition of the DALI ECGs from Touch DIM to DALI occurs automatically after the power voltage disruption to the ECGs, when sending the first DALI command.
Touch DIM and DALI are not allowed at the same time!

— **Can the motion function of the Touch DIM sensor be temporarily switched off (vacation switching)?**
Yes, so-called vacation switching prevents the motion sensor switching it on. Activated by double-clicking the push-button if dimming has not been triggered manually beforehand within the last 30 seconds. The motion sensor is activated by pressing the push-button.

9.1.2 DALI in general

— **Do the ECGs have to be addressed with DALI?**
No, it will also work without addressing (broadcast mode).

— **What is the difference between DSI and DALI?**
DSI is a company-specific solution, not a universal manufacturer standard like DALI. Digital addressing is not possible with DSI and, therefore, no free group formation and no individual query is possible after errors. Groups must be formed through wiring, as in the 1…10-V technology.

— **Does the DALI group assignment need to be observed when wiring?**
No, the group is not assigned (addressing) until first commissioned.

— **Does the polarity of the DALI control line need to be observed?**
The polarity does not have to be observed when using OSRAM DALI control gears.

— **How can DALI ECGs be addressed?**
They can be addressed individually, in groups or all together.

— **Can I receive feedback from the DALI ECGs?**
Yes, all device settings as well as the device status (lamp malfunction, for example) can be queried.

— **Can a DALI ECG belong to several groups at once?**
Yes. Each DALI control gear can belong to up to 16 groups.

— **Where are the data for group membership and scene light values saved?**
It is saved directly in the ECG internal EEPROM.

— **Are data in the ECG lost in the event of power failure?**
No, the data are permanently stored in the ECG. They are also retained after a longer power failure.

— **What happens when an ECG fails?**
The ECG just needs to be replaced and equipped with the corresponding individual settings (the procedure depends on the control unit used).

— **What happens if a control unit is defective?**
If the DALI interface voltage is lost, all ECGs implement a so-called “system failure level” (factory setting: 100 % light).

— **Is it possible to integrate DALI into superordinate building management systems (e.g. KNX or LON)?**
Yes, using gateways or control units with the corresponding interface.

— **Is DALI a competitor of KNX or LON?**
No, DALI works as a sub-system of the building management system to control light.

— **Can 1...10-V components be integrated into a DALI light management system?**
Yes, using a converter from DALI to 1…10 V.

— **Can existing 1...10-V light systems be upgraded with a DALI control unit?**
Yes, only one converter from DALI to 1…10 V is needed for each 1…10-V luminaire group (e.g. DALI CON 1…10 SO).

— **Can the wiring of the DALI ECGs be inspected at the building site?**
This depends on the control unit used. DALI ECGs new from the factory are always set to 10 % light when applying the mains voltage (with fuse).

— **Which insulation should be used for the DALI control line?**
The DALI control line must be approved for mains voltage (as with the 1…10-V interface).

— **Can existing 1...10-V control lines be used for DALI?**
Yes (line rated for mains voltage).

— **What is the maximum permissible length of the control line?**
Maximum 300 m is allowed between the control unit and the farthest DALI consumer.

— **Can control and supply lines be routed together?**
Yes, a 5-x-1.5-mm^2 NYM cable can be used, for example.

— **What should the cable cross section of the control line be?**
  — Up to 100 m: min. 0,5 mm^2
  — From 100 m to 150 m: 1,0 mm^2
  — From 150 m: 1,5 mm^2

— **Can anyone develop a DALI control unit or ECG?**
Yes, there are no restrictions. Using the DALI logo, however, is only allowed for members of the DALI Group.

— **What happens when DALI ECGs from different manufacturers are used in a single system?**
The devices are DALI-compliant if they bear the DALI logo. However, bear in mind that as with the 1…10-V technology, various filament preheating times in the ECGs from different device manufacturers lead to deviating lamp switch-on times.

— **Can control units from different manufacturers be combined?**
No, only the DALI ECGs can be exchanged in a control system, not the control components.

— **Can a maximum and minimum luminous flux limit be set?**
Yes, the values can be changed/limited with the corresponding control unit.

9.1.3 Converter from DALI to 1...10 V

— **Can the converter from DALI to 1...10 V be used for switching and dimming?**
Yes, both are possible with the converter.

— **Is the Touch DIM Function also possible with the converter?**
Yes, the converter acts just like a DALI ECG in Touch DIM mode 1.

— **Why does the converter have a characteristic line switch?**
It compensates for the different behaviors of the incandescent lamps and the fluorescent lamps. Depending on whether the converter supplies fluorescent lamps/ECGs or a dimmer for incandescent lamps, either a logarithmic (for fluorescent lamps) or linear (incandescent lamps) characteristic line should be selected.

9.1.4 Troubleshooting Touch DIM mode

Before troubleshooting, please ensure that the device is wired according to the operating instructions and that the corresponding supply voltage is applied. In the case of luminaires, also inspect and, if necessary, exchange the light source.

— **ECGs do not react as expected to a push-button being pressed.**
If the push-button was held for too long (>1 second), then the lamp starts on its lowest dimmer setting, which is hard to see in bright surroundings.

— **Individual luminaires vary in brightness, contrast with one another.**
➔ Manual synchronization of the system:
— Hold the push-button pressed (> 3 s; all lamps on)
— Briefly press the push-button (all lamps are switched off)
— Hold the push-button pressed (all lamps switch on in the lowest dimmer setting and dim up)

— **The ECGs react without a push-button having been pressed.**
1. The line between the push-button and the luminaire (ECG) may be too long.
2. A push-button with glow lamp was used; this is not permitted.

— **The motion detector of the Touch DIM sensor is not working.**
1. The luminaires were switched off by double-clicking the push-button, thus deactivating the motion detection function (vacation switching).
2. The existing daylight is sufficient. Cover the sensor and observe the behavior of the luminaire.
3. The motion detector is deactivated for 30 s after manual shutdown. This time only expires once there are no longer any persons in the detection area.

— **The luminaire does not control the brightness at the adjusted setpoint.**
1. You must press the push-button twice within 30 s after setting the brightness (setpoint saving). Pressing the push-button later activates the vacation switching.
2. Dimming was done manually – the brightness control is thus deactivated. Switch the luminaire off and back on again.
3. No setpoint wast saved. Set the desired light value, save with double-click.

— **The vacation switching cannot be activated.**
The brightness was changed less than 30 s ago by pressing the push-button – vacation switching can only be activated after this period.

9.1.5 Troubleshooting DALI control gears

— **The ECGs are not reacting to the command of the control unit.**
Please inspect the wiring; approx. 16 V_{DC} must be applied to the DALI terminal of the ECG.

9.1.6 Converter from DALI to 1...10 V

— **Not all rows of luminaires can be switched off.**
Please inspect whether the mains supply of the affected rows of luminaires have been routed over the load contact of the corresponding converter.

9.2 1...10-V DIM ECG part

— **What is the maximum permissible length of the 1...10-V control line?**
The maximum permissible length of the control line is 100 m.

— **What should the cable cross section of the 1...10-V control line be?**
The recommended cross section is 1.5 mm^2. The insulation of the cables used must be designed for mains voltage.

— **Can control and supply lines be routed together?**
Routing control and supply lines together is permitted (VDE 0100 520, section 528.11). The following points should be taken into account:
— The lines used must be suitable for the highest occurring operating voltage (VDE 0100/11.85, T520, section 528.11).
— When routing multi-wire cables in cabling tubes or channels, only the wire of a main current circuit and those of associated auxiliary current circuits may be laid together.
— Several main current circuits and their associated auxiliary current circuits may be combined in a single cable (according to DIN VDE 0100/11.85, T520, section 528.11).

— **How can I easily and cost-effectively control a permanently set level of lighting?**
Easily controlling preset levels of lighting with 100 % or 1 % luminous flux and multiple values in between is possible using fixed resistors or Zener diodes.

— **Can dimmable 1…10-V ECGs from OSRAM be used for emergency lighting?**
Yes, however, using dimmable ECGs in emergency lighting systems is associated with additional costs. Components such as signal amplifiers, the ICM 10 or the module that holds the light constant would have been destroyed when the DC voltage was connected. This means that these components must be disconnected from the mains when switching to a supply with DC voltage.

— **Can bi-pin base compact fluorescent lamps be dimmed?**
No, ECG operation with bi-pin lamps is not generally permitted. The glow igniter integrated into the base can cause problems, such as poor and unreliable ignition, shortened lifetime or destruction of the ECG. Additional heating of the lamp electrodes is not possible in dimmed operation, which would lead to a clearly shorter lifetime. As a general rule, only 4-pin base lamps with the designation /E (e. g. DULUX S/E, D/E, T/E) can be operated on the ECG and used for dimming.

— **Does continuous operation in the lower dimmer setting influence the lifetime of fluorescent lamps?**
Long-term operation of fluorescent lamps and ECGs from OSRAM in dimmed states does not have a negative influence on the lifetime of the lamp.

9.2.1 Troubleshooting 1…10 V

— **The lamp does not burn with 100 % luminous flux.**
The control line is not or is incorrectly attached to the control unit, or the current unit is insufficient as a current sink and, therefore, cannot reduce the control voltage. Inspect the wiring. Inspect whether the control voltage is reduced when dimming; if necessary, integrate parallel resistance into the control line. Likewise, one or more control inputs could be reverse-polarized:
  — Disconnect control unit
  — Split up control circuit
  — Split up control circuit further

— **Lamp always burns with minimum brightness.**
Plus and minus connection of the control line are switched, or short circuit in the control line. Connect lines with right polarity, inspect wiring.

— **The lamp does not exhibit the desired luminous flux when controlled with potentiometer or fixed resistors.**
The potentiometer or resistors are incorrectly dimensioned. Check the values.

— **Insufficient brightness along the lamp.**
Reflector distance to the lamp is too small; capacitive leakage currents are occurring. Increase the distance between the reflector and the lamp.

— **Synchronized lamp flickering.**
The error is outside the dimming system, for example, N-wire disruption, control voltage not OK. Inspect the N-wire connection and control unit.

10 Appendix

10.1 Inrush currents and maximum number of ECGs with circuit breakers (B characteristics), measured at $U_N = 230V_{AC}$

Inrush currents and maximum number of ECGs with circuit breakers (B characteristics)

Product reference	I [A]	th [µs]	n (B10) n (B16)
QTi (DALI) 1x14/24 DIM	24	174	17 (B10) 28 (B16)
QTi (DALI) 1x21/39 DIM			
QTi (DALI) 1x28/54 DIM			
QTi (DALI) 1x35/49/80 DIM	28	224	12 (B10) 19 (B16)
QTi (DALI) 2x14/24 DIM	35	180	12 (B10) 19 (B16)
QTi (DALI) 2x21/39 DIM	45	204	8 (B10) 13 (B16)
QTi (DALI) 2x28/54 DIM			
QTi (DALI) 2x35/49 DIM			
QTi (DALI) 2x35/49/80 DIM	60	230	5 (B10) 9 (B16)
QTi (DALI) 3x14/24 DIM	35	180	12 (B10) 19 (B16)
QTi (DALI) 4x14/24 DIM	45	205	8 (B10) 13 (B16)
QTi (DALI) 1x18 DIM	24	174	17 (B10) 28 (B16)
QTi (DALI) 1x36 DIM			
QTi (DALI) 1x58 DIM			
QTi (DALI) 2x18 DIM	35	180	12 (B10) 19 (B16)
QTi (DALI) 2x36 DIM	45	204	8 (B10) 13 (B16)
QTi (DALI) 2x36 DIM			
QTi (DALI) 3x18 DIM	35	180	12 (B10) 19 (B16)
QTi (DALI) 4x18 DIM			
QTi (DALI)-T/E 1x18–57 DIM (3…100 %)	28	224	12 (B10) 19 (B16)
QTi (DALI)-T/E 2x18–42 DIM (3…100 %)	45	204	8 (B10) 13 (B16)

I [A]: Amplitude of the inrush current

t_h [µs]: Pulse width

10.1.1 Trigger thresholds B/C characteristics

The trigger thresholds increase from the B to C characteristics by the factor 5/3 = 1.67, i.e. not quite by a factor of 2. At the same time, however, the total current must not exceed the value of the circuit breakers.

10.2 DALI fade time and fade rate

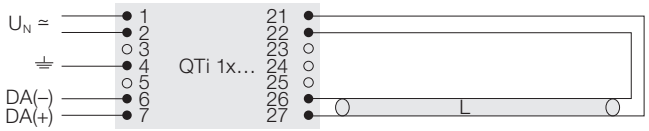
The fade time is adjustable in 16 levels (0 to 15) and designates the cross fade time between two scenes (room light conditions). The fade rate, also adjustable in 16 levels, designates the number of dimming steps executed every second and is used for manual dimming processes.

Fade time and fade rate dimmable OSRAM DALI control gears

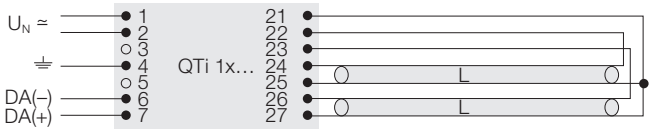
Setting	Fade time (s)	Fade rate (steps/s)
0	<0.7	Not possible
1	0.7	357.8
2	1.0	253.0
3	1.4	178.9
4	2.0	126.5
5	2.8	89.5
6	4.0	63.3
7	5.7	44.7
8	8.0	31.6
9	11.3	22.4
10	16.0	15.8
11	22.6	11.2
12	32.0	7.9
13	45.3	5.6
14	64.0	3.9
15	90.5	2.8

10.3 Lamp wirings

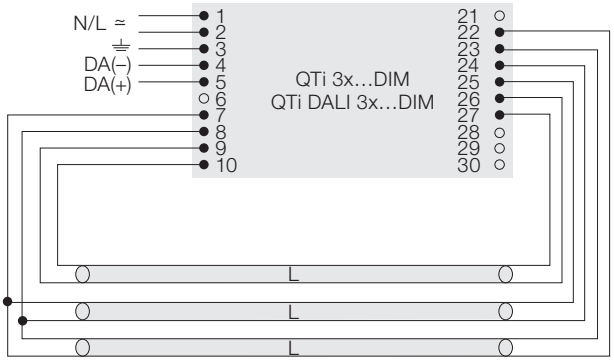
QTi DALI/DIM 1x: Lines 26 and 27
Max. length: 1 m



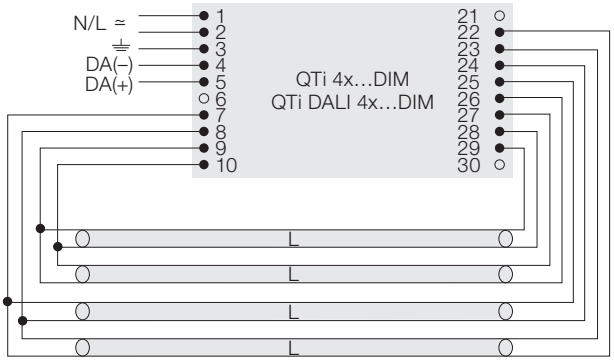
QTi DALI/DIM 2x: Lines 24, 25 and 26, 27
Max. length: 1 m



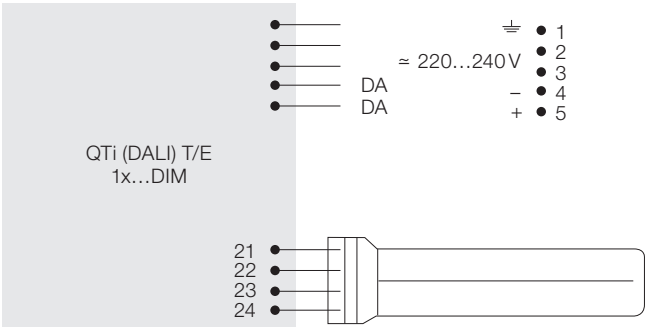
QTi DALI/DIM 3x



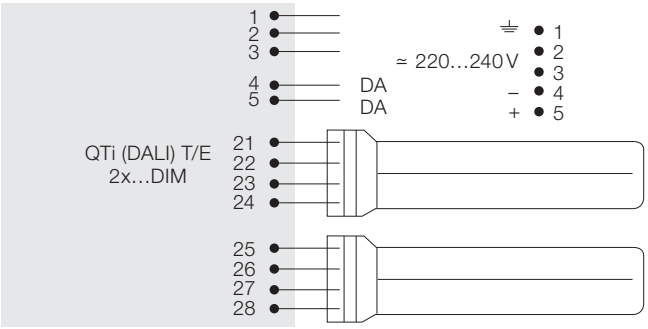
QTi DALI/DIM 4x



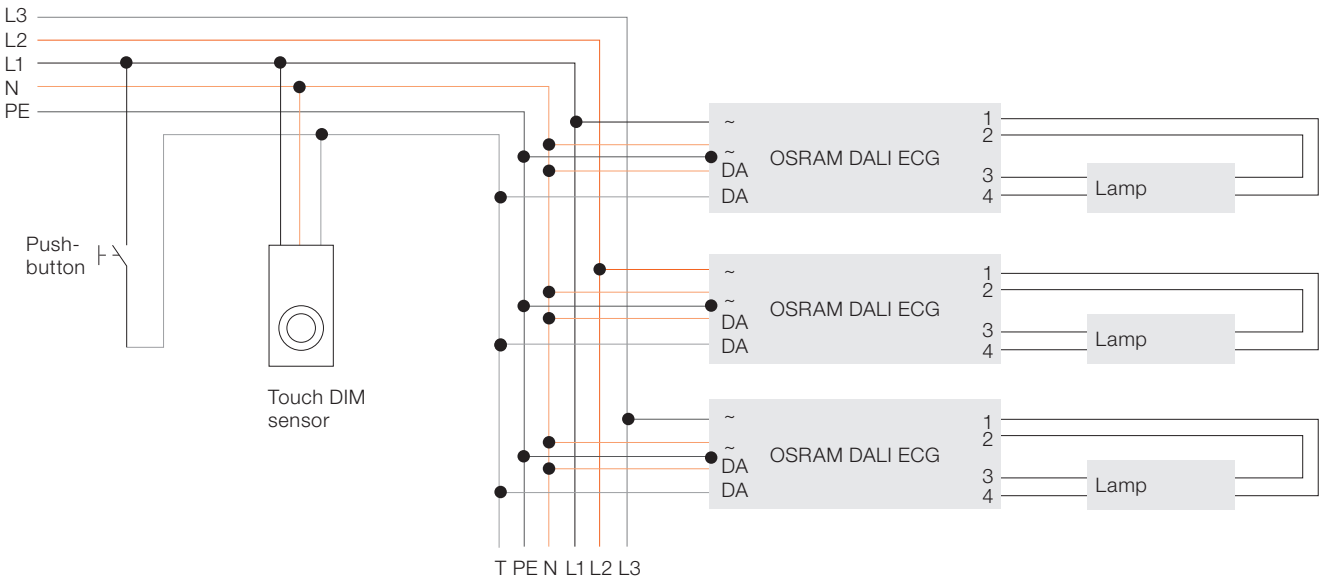
QTi DALI/DIM 1x



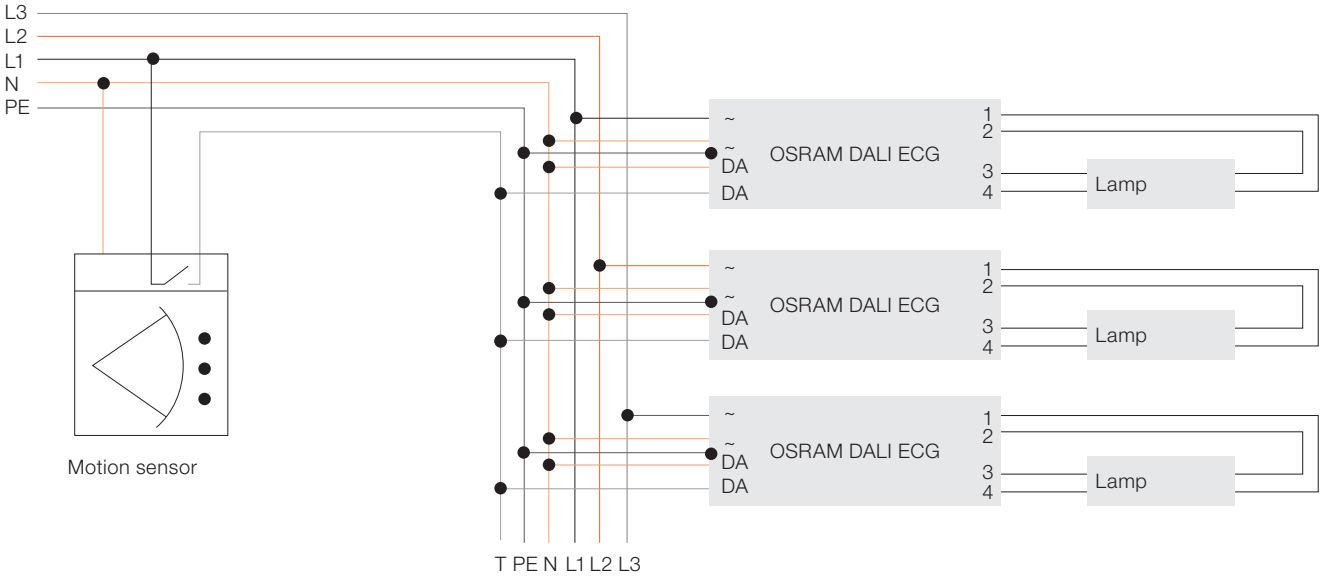
QTi DALI/DIM 2x



Touch DIM Function wiring



Corridor Function wiring



10.4 Design/dimensions

Luminaire installation housing:
1-lamp, all T5 and T8 lamps: 360 x 30 x 21 mm (L x W x H, metal housing)
2-lamp, all T5 and T8 lamps: 423 x 30 x 21 mm (L x W x H, metal housing)
1/2-lamp K3: 123 x 79 x 33 mm (L x W x H, plastic housing)

10.5 Operating parameters of lamp/ECG combinations

Product reference	Lamp CONSTANT = Amalgam lamp SLS = Seamless lamp ES = Energy Saver lamp XT = Longlife lamp	IN [A]	Lamp [W]	System [W] N100 %*	System [W] N1 %*	Power factor λ
QTi (DALI) 1x14/24 DIM	1xHE 14W (SLS**)	0.07	13.7	15.4	5.5	0.95
	1xHE 13W ES	0.07	13.7	15.4	5.5	0.95
	1xHO 24W (CONSTANT)	0.11	22.5	25.3	5.5	0.98
	1xHO 20W ES	0.11	22.5	25.3	5.5	0.98
	1xDL 24W	0.11	22.5	25.3	5.5	0.98
QTi (DALI) 1x21/39 DIM	1xHE 19W ES	0.11	20.7	23.1	5.5	0.95
	1xHE 21W (SLS)	0.11	20.7	23.1	5.5	0.95
	1xHO 34W ES	0.18	38.0	41.8	7.0	0.98
	1xHO 39W (CONSTANT, SLS)	0.18	38.0	41.8	7.0	0.98
	1xDL 22W HE	0.11	20.7	23.1	5.5	0.95
	1xDL 40W (CONSTANT)	0.18	38.0	41.8	7.0	0.98
	1xF 70W	0.29	60.0	65.2	8.5	0.99
QTi (DALI) 1x28/54 DIM	1xHE 25W ES	0.14	27.8	30.1	6.5	0.97
	1xHE 28W (SLS)	0.14	27.8	30.1	6.5	0.97
	1xHO 50W ES	0.26	53.8	58.8	8.5	0.99
	1xHO 54W (CONSTANT, SLS, XT)	0.26	53.8	58.8	8.5	0.99
	1xDL 55W (CONSTANT, XT)	0.26	53.8	58.8	8.5	0.99
	1xDL 26W HE	0.14	27.8	30.1	6.5	0.97
	1xDL 28W HE	0.14	27.8	30.1	6.5	0.97
QTi (DALI) 1x35/49/80 DIM	1xHE 32W ES	0.17	34.8	37.8	6.5	0.95
	1xHE 35W (XT)	0.17	34.8	37.8	6.5	0.95
	1xHO 45W ES	0.24	49.3	53.4	6.0	0.98
	1xHO 49W (CONSTANT, XT, CONSTANT XT****)	0.24	49.3	53.4	6.0	0.98
	1xHO 73W ES	0.39	80.0	88.1	8.5	0.99
	1xHO 80W (CONSTANT, XT, CONSTANT XT)	0.39	80.0	88.1	8.5	0.99
	1xDL 80W (CONSTANT)***	0.39	80.0	88.1	8.5	0.99
QTi (DALI) 2x14/24 DIM	2xHE 14W (SLS**)	0.14	13.7	30.6	8.2	0.95
	2xHE 13W ES	0.14	13.7	30.6	8.2	0.95
	2xHO 24W (CONSTANT)	0.22	22.5	49.3	9.8	0.98
	2xHO 20W ES	0.22	22.5	49.3	9.8	0.98
	2xDL 24W	0.22	22.5	49.3	9.8	0.98
QTi (DALI) 2x21/39 DIM	2xHE 19W ES	0.21	20.7	45.0	9.1	0.95
	2xHE 21W (SLS)	0.21	20.7	45.0	9.1	0.95
	2xHO 34W ES	0.36	38.0	82.0	10.9	0.98
	2xHO 39W (CONSTANT, SLS)	0.36	38.0	82.0	10.9	0.98
	2xDL 22W HE	0.21	20.7	45.0	9.1	0.95
	2xDL 40W (CONSTANT)	0.36	38.0	82.0	10.9	0.98
	2xF 70W	0.56	60.0	128.0	16.0	0.99
QTi (DALI) 2x28/54 DIM	2xHE 25W ES	0.27	27.8	60.2	10.7	0.97
	2xHE 28W (SLS)	0.27	27.8	60.2	10.7	0.97
	2xHO 50W ES	0.51	53.8	115.0	14.5	0.99
	2xHO 54W (CONSTANT, SLS, XT)	0.51	53.8	115.0	14.5	0.99
	2xDL 55W (CONSTANT, XT)	0.51	53.8	115.0	14.5	0.99
	2xDL 26W HE	0.27	27.8	60.2	10.7	0.97
	2xDL 28W HE	0.27	27.8	60.2	10.7	0.97
QTi (DALI) 2x35/49 DIM	2xHE 32W ES	0.33	34.8	74.5	11.5	0.98
	2xHE 35W (XT)	0.33	34.8	74.5	11.5	0.98
	2xHO 45W ES	0.45	49.3	103.6	13.2	0.99
	2xHO 49W (CONSTANT, XT, CONSTANT XT)	0.45	49.3	103.6	13.2	0.99

Product reference	Lamp CONSTANT = Amalgam lamp SLS = Seamless lamp ES = Energy Saver lamp XT = Longlife lamp	IN [A]	Lamp [W]	System [W] N100 %*	System [W] N1 %*	Power factor λ
QTi (DALI) 2x35/49/80 DIM	2xHE 32W ES	0.34	34.7	74.0	11.0	0.95
	2xHE 35W (XT)	0.34	34.7	74.0	11.0	0.95
	2xHO 45W ES	0.45	48.5	101.0	12.1	0.97
	2xHO 49W (CONSTANT, XT, CONSTANT XT)	0.45	48.5	101.0	12.1	0.97
	2xHO 73W ES	0.72	77.0	165.0	17.4	0.99
	2xHO 80W (CONSTANT, XT, CONSTANT XT)	0.72	77.0	165.0	17.4	0.99
	2xDL 80W (CONSTANT)***	0.72	77.0	165.0	17.4	0.99
QTi (DALI) 3x14/24 DIM	3xHE 14W	0.2	13.7	44.6	10.6	0.97
	3xHE 13W ES	0.2	13.7	44.6	10.6	0.97
	3xHO 24W (CONSTANT)	0.32	22.5	72.9	13.7	0.99
	3xHO 20W ES	0.32	22.5	72.9	13.7	0.99
	3xDL 24W	0.32	22.5	72.9	13.7	0.99
QTi (DALI) 4x14/24 DIM	4xHE 14W	0.27	13.7	60.2	14.9	0.97
	4xHE 13W ES	0.27	13.7	60.2	14.9	0.97
	4xHO 24W (CONSTANT)	0.43	22.5	97.9	18.2	0.99
	4xHO 20W ES	0.43	22.5	97.9	18.2	0.99
	4xDL 24W	0.43	22.5	97.9	18.2	0.99
QTi (DALI) 1x18 DIM	1xL 18W	0.08	16.0	18.3	5.5	0.97
	1xDL 18W	0.08	16.0	18.3	5.5	0.97
QTi (DALI) 1x36 DIM	1xL 36W	0.16	32.0	36.0	6.5	0.98
	1xDL 36W (XT)	0.16	32.0	36.0	6.5	0.98
QTi (DALI) 1x58 DIM	1xL 58W	0.25	50.0	55.6	8.0	0.99
QTi (DALI) 2x18 DIM	2xL 18W	0.16	16.0	36.5	8.5	0.97
	2xDL 18W	0.16	16.0	36.5	8.5	0.97
QTi (DALI) 2x36 DIM	2xL 36W	0.31	32.0	69.0	11.0	0.98
	2xDL 36W (XT)	0.31	32.0	69.0	11.0	0.98
QTi (DALI) 2x58 DIM	2xL 58W	0.47	50.0	108.0	14.4	0.99
QTi (DALI) 3x18 DIM	3xL 18W	0.24	16.0	54.1	11.6	0.98
QTi (DALI) 4x18 DIM	4xL 18W	0.31	16.0	70.6	15.9	0.99
QTi (DALI)-T/E 1x18–57 DIM (3…100 %)	1xT/E 18W	0.09	17.7	20.0	4.5	0.95
	1xD/E 26W (XT)	0.13	25.1	29.0	5.8	0.97
	1xT/E 26W (CONSTANT)	0.13	25.1	29.0	5.8	0.97
	1xT/E 32W (CONSTANT, XT)	0.16	32.0	36.0	6.2	0.98
	1xT/E 42W (CONSTANT, XT)	0.21	42.7	47.0	6.6	0.99
	1xFC 22W	0.12	21.9	26.0	5.2	0.96
	1xFC 40W	0.20	40.0	45.0	6.5	0.98
	1xDL 24W	0.12	21.9	26.0	5.2	0.96
	1xDL 40W	0.20	40.0	45.0	6.5	0.98
QTi (DALI)-T/E 2x18–42 DIM (3…100 %)	2xT/E 18W	0.17	16.7	38.0	8.8	0.95
	2xD/E 26W (XT)	0.25	24.4	56.0	10.0	0.98
	2xT/E 26W (CONSTANT)	0.25	24.4	56.0	10.0	0.98
	2xT/E 32W (CONSTANT, XT)	0.30	30.8	69.0	11.0	0.99
	2xT/E 42W (CONSTANT, XT)	0.39	41.0	90.0	12.4	0.99
	2xFC 22W	0.22	22.2	51.0	9.7	0.97
	2xFC 40W	0.38	39.6	87.0	12.1	0.99
	2xDL 24W	0.22	22.2	51.0	9.7	0.97
	2xDL 40W	0.38	39.6	87.0	12.1	0.99
	1xFC 22W+1xFC 40W	0.30	31.2	70.0	10.9	0.98

* At +25 °C lamp ambient temperature

** Max. distance to the luminaire reflector: 1 cm

*** Dimming time: 1 % – 100 % > 1 s

**** When IC < AA38XXXXXDG: Reduce dimming range to 25 % – 100 %

Product reference	t_a [°C] Full dimming range 1...100 %	kHz ECG	Weight	I [A]	t_h [µs]	n (B10) n (B16)
QTi (DALI) 1x14/24 DIM	+10...50 (SLS HO: +15…50)	53…120	305	24	174	17 (B10) 28 (B16)
QTi (DALI) 1x21/39 DIM	+10...50 (SLS HO: +15…50)	44…120	305	24	174	17 (B10) 28 (B16)
QTi (DALI) 1x28/54 DIM	+10...50 (SLS HO: +15…50)	44…120	305	24	174	17 (B10) 28 (B16)
QTi (DALI) 1x35/49/80 DIM	+10...50 (SLS HO: +15…50)	44…120	305	28	224	12 (B10) 19 (B16)
QTi (DALI) 2x14/24 DIM	+10...50 (SLS HO: +15…50)	53…120	370	35	180	12 (B10) 19 (B16)
QTi (DALI) 2x21/39 DIM	+10...50 (SLS HO: +15…50)	44…120	370	45	204	8 (B10) 13 (B16)
QTi (DALI) 2x28/54 DIM	+10...50 (SLS HO: +15…50)	44…120	370	45	204	8 (B10) 13 (B16)
QTi (DALI) 2x35/49 DIM	+10...50 (SLS HO: +15…50)	44…120	370	45	204	8 (B10) 13 (B16)
QTi (DALI) 2x35/49/80 DIM	+10...50 (SLS HO: +15…50)	44…120	370	60	230	5 (B10) 9 (B16)
QTi (DALI) 3x14/24 DIM	+10...50 (SLS HO: +15…50)	40…100	420	35	180	12 (B10) 19 (B16)
QTi (DALI) 4x14/24 DIM	+10...50 (SLS HO: +15…50)	40…100	420	45	205	8 (B10) 13 (B16)
QTi (DALI) 1x18 DIM	1xL 18W: -20...50 1xDL 18W: +10...50	51…120	305	24	174	17 (B10) 28 (B16)
QTi (DALI) 1x36 DIM	1xL 36W: -20...50 1xDL 36W (XT): +10...50	48…120	305	24	174	17 (B10) 28 (B16)
QTi (DALI) 1x58 DIM	-20...50	46…120	305	24	174	17 (B10) 28 (B16)
QTi (DALI) 2x18 DIM	2xL 18W: -20...50 2xDL 18W: +10...50	51…120	370	35	180	12 (B10) 19 (B16)
QTi (DALI) 2x36 DIM	2xL 36W: -20...50 2xDL 36W (XT): +10...50	48…120	370	45	204	8 (B10) 13 (B16)
QTi (DALI) 2x58 DIM	-20...50	46…120	370	45	204	8 (B10) 13 (B16)
QTi (DALI) 3x18 DIM	-20...50	40…100	420	35	180	12 (B10) 19 (B16)
QTi (DALI) 4x18 DIM	-20...50	40…100	420	35	180	12 (B10) 19 (B16)
QTi (DALI)-T/E 1x18-57 DIM (3…100%)	+10...50	42…130	206	28	224	12 (B10) 19 (B16)
QTi (DALI)-T/E 2x18-42 DIM (3…100%)	+10...50	42…130	222	45	204	8 (B10) 13 (B16)

10.6 Energy classifications

Typical control gears fall into the following classes according to the CELMA classification system:

- Class D: Magnetic control gears with extremely high losses
- Class C: Magnetic control gears with moderate losses
- Class B2: Magnetic control gears with low losses
- Class B1: Magnetic control gears with extremely low losses
- Class A3: Electronic control gears (ECGs)
- Class A2: Electronic control gears with reduced losses
- Class A1: Dimmable electronic control gears

Dimmable ECGs are classified as A1 BAT if they fulfill the following requirements:

- With a light power setting of 100 %, the ECG achieves at least the requirements according to A2 (OSRAM DIM ECGs even achieve A2 BAT).
- With a light power setting of 25 %, the total power is the same or less than 50 % of the power at the 100-% light power setting.
- The ECG must be able to reduce the light intensity to 10 % or less than the maximum power.
- For DALI (switching off the light using the bus command possible) standby consumption of the luminaire < 0.5 W (OSRAM DALI-ECG < 0.2 W ➔ two ECGs per luminaire possible).

10.7 Overview of the DALI standard (IEC 62386)

- Every ECG must fulfill part 102 (see table to the right).
- A single ECG may belong to more than one type of device (see part 100, 200, 300).
- Specific commands and properties for ECGs are defined and described in the parts numbered 2XX.
- Control units are described in parts 103 and 3XX.

Overview of IEC 62386

Digital Addressable Lighting Interface Standard IEC 62386

Part 100: General requirements	**Part 200: Special requirements for control gears**	**Part 300: Special requirements for control units**
Part 101: System	Part 201: Fluorescent lamps	Part 301: Push-button and binary inputs [2]
Part 102: Control gears	Part 202: Emergency lighting	Part 302: Light sensor [2]
Part 103: Control units [1]	Part 203: Discharge lamps (HID)	Part 303: Motion sensors [2]
	Part 204: Low-voltage halogen lamps	
	Part 205: Incandescent bulbs	
	Part 206: Conversion to DC	
	Part 207: LED modules	
	Part 208: Switching function	
	Part 209: Color control	
	Part 210: Sequencer	

1) In progress, available as IEC draft.

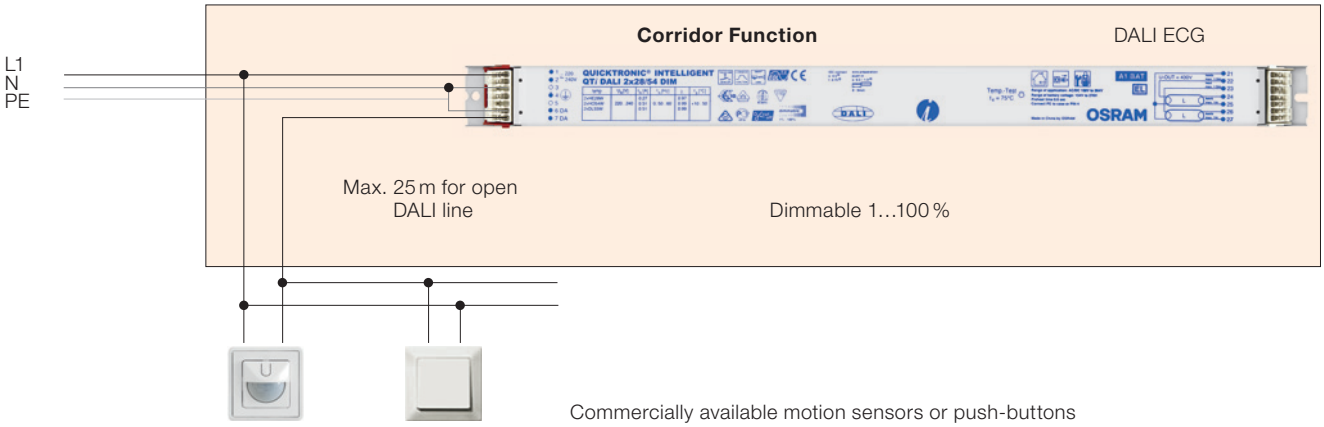
2) Working title, available as an IEC draft.

10.8 Installation instructions for the Corridor Function

QUICKTRONIC® Intelligent DALI GII, cable length: < 25 m

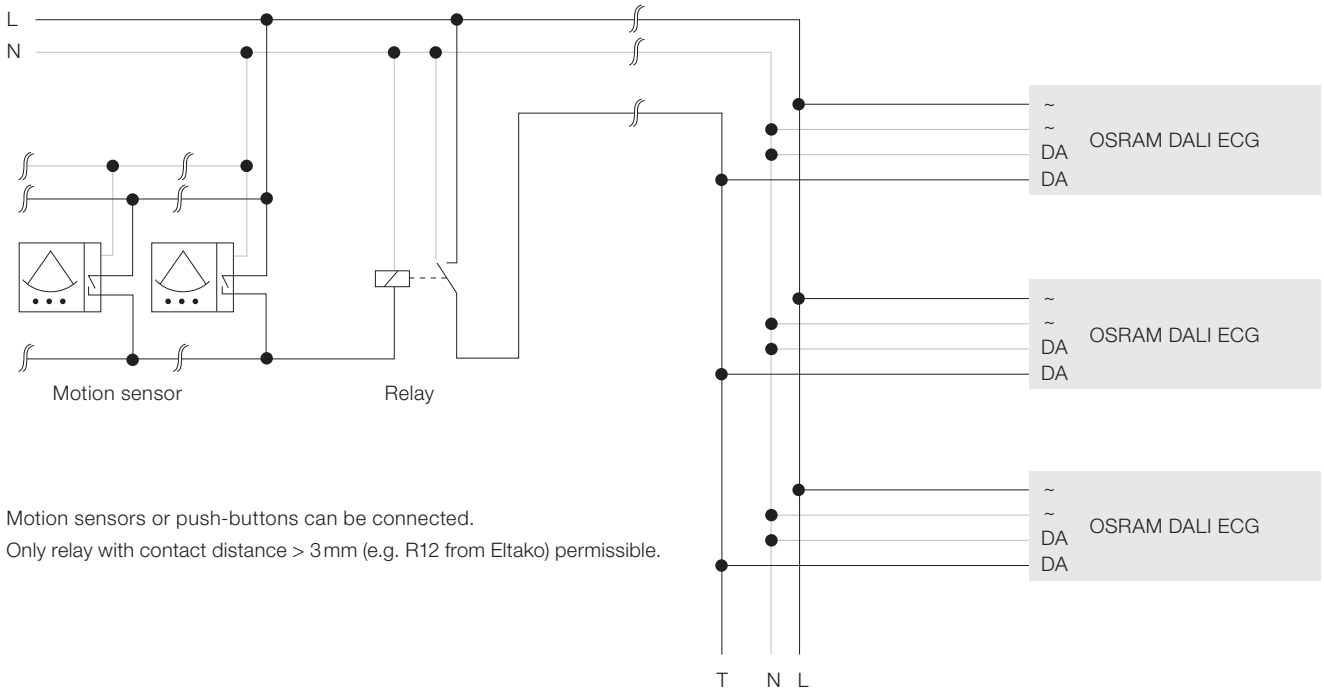
SMART GRID | CORRIDOR FUNCTION | TOUCH DIM SENSOR

Integrated light management system



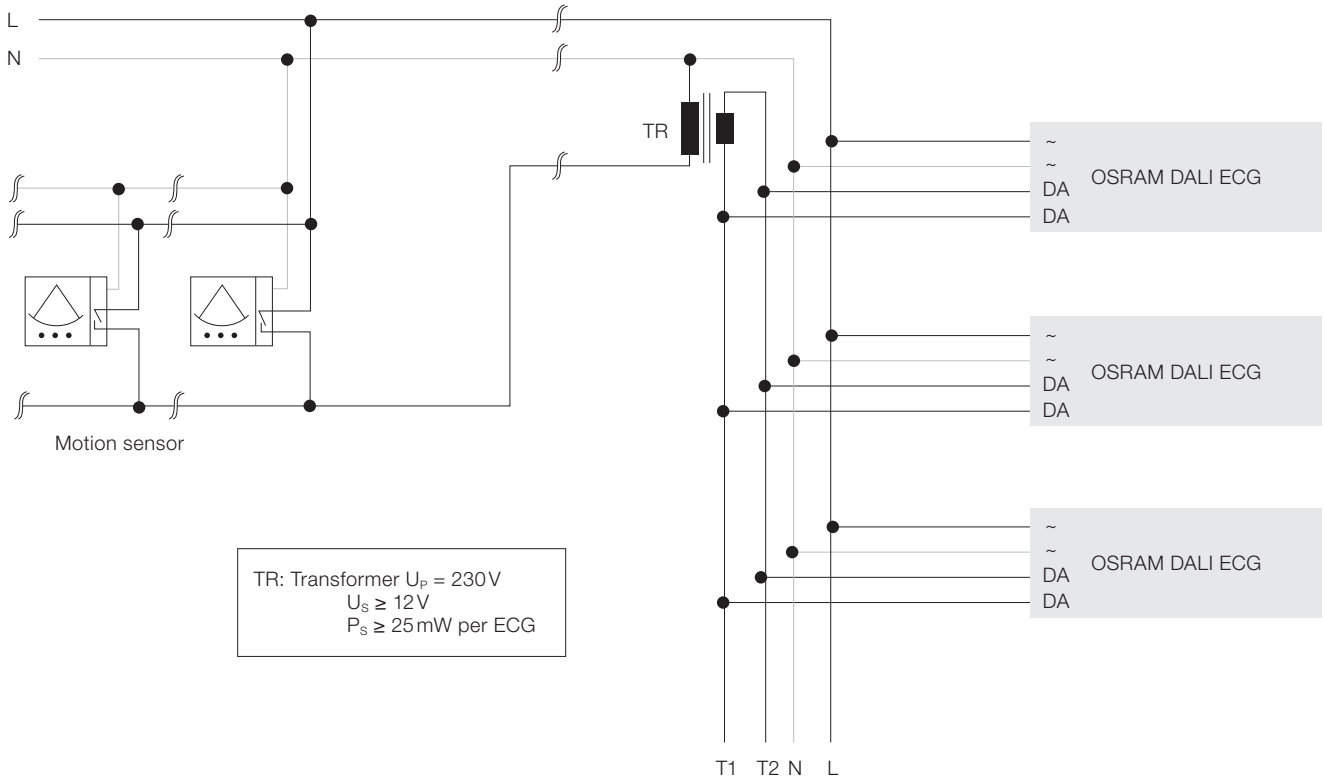
Commercially available motion sensors or push-buttons

Cable length up to 100 m, solution with relay

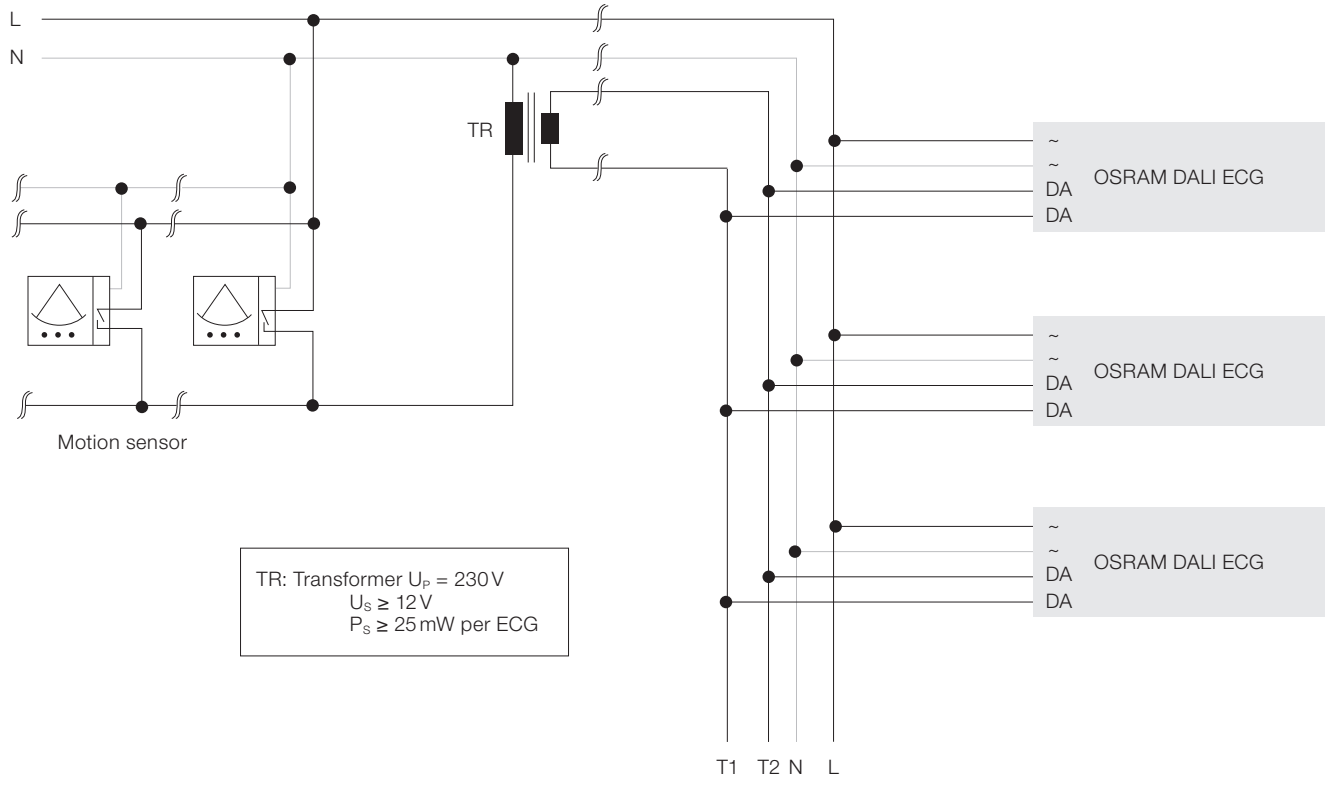


Motion sensors or push-buttons can be connected.
Only relay with contact distance > 3 mm (e.g. R12 from Eltako) permissible.

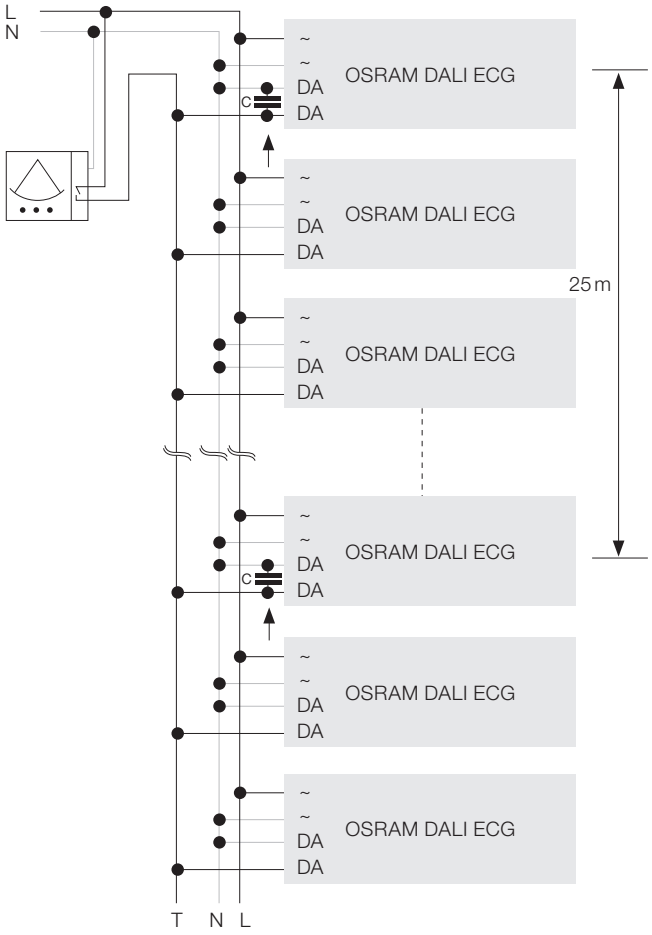
Cable length up to 100 m, control transformer for compensation near the ECG (e.g. in a luminaire)



Cable length up to 100 m, control transformer near the push-button (e.g. in the SD (sub-distributor) or an FTB (flush-type box)).



Line length up to 100 m, compensation capacity



11 General application note

Creating a sample setup for new luminaires or those with a change in design or application is recommended.

This sample setup should be accurately tested under the conditions occurring in the application (ambient temperature, dimmer settings etc.).

A sample setup is the only way to make necessary design adaptations to achieve the desired system properties (e. g. distance changes lamp/luminaire components, type of lamp mounting, altered cable layout etc.).

02/14 OSRAM S-GI MK EM Subject to technical changes and corrections.

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